A MODEL REPRESENTING THE FACTORS THAT INFLUENCE VIRTUAL LEARNING SYSTEM USAGE IN HIGHER EDUCATION

by

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ABSTRACT

In higher education institutions, virtual learning systems (VLSs) have been adopted, and are becoming increasingly popular among educators. However, despite this ubiquity of VLS use, there has not been widespread change in pedagogic practice to take advantage of the functionality afforded by VLSs. Knowledge of the actual usage of e-learning systems is limited in terms of what specific feature sets are deemed useful, and how this influences system usage. VLSs have a suite of tools with associated functions/features and properties, as well as non-functional system characteristics. In addition, these systems incorporate pedagogic features to cater for online teaching. Educators in higher education, who are the chief agents of e-learning, are confounded by system-related, pedagogic, organisational, user difference and demographic factors that influence VLS usage. Virtual learning system usage involves system feature usage extent and frequency, total system usage and usage clusters.

The aim of this study is to develop a model representing the factors that influence usage of VLSs in higher education. The links between system usage and system-related factors, pedagogic factors, organisational factors, user-difference and demographic factors is researched.

This research incorporated a literature study, a pilot study, interviews and surveys. A case study research strategy was combined with a mixed methods research design. The results of the qualitative analysis was triangulated with the findings of the quantitative analysis and compared to the findings of the literature study. The study was conducted at two residential higher education institutions (HEI), namely, University of KwaZulu-Natal and Durban University of Technology.

The main contribution of this study is the Virtual Learning System Usage Model (VLSUM) representing the factors that influence VLS usage in residential higher education institutions. The proposed VLSUM is based on the empirical results of this study. VLSUM can be used by managers of educational technology departments and instructional designers to implement interventions to optimize usage.

The constructs of VLSUM confirmed existing theories, replicated and synthesised theories from different fields, and extended existing models to produce a new model for understanding the factors that influence VLS usage in higher education.

Key words: Virtual learning system usage, course management systems, learning management systems, educational technology, e-learning, system factors, pedagogic factors, organisational factors, user difference factors, technology adoption, technology utilisation, feature usage extent, feature usage frequency, usage clusters.

PREFACE

The presentation of the VLSUM in Chapter 8, section 8.3, was accompanied by a description of model components and factors. The generic terms in the following table became component and factor names and were presented using the capitalization naming convention and a combination of uppercase and italics to differentiate between component names and factor names. For example, the following component names were capitalised ACTUAL SYSTEM USAGE, SYSTEMS FACTORS, and INFLUENTIAL FACTORS. Component and factors names were used consistently from Chapter 8, section 8.3, onwards through to Chapter 11 whenever reference was made to components and factors contained within the VLSUM.

Generic terms	Related general terminology
usage	actual system usage; total system usage; extent of feature usage; frequency of feature usage; and usage clusters.
influential factors	system factors; perceived usefulness; perceived importance; pedagogic factors; organisational factors; user difference factors; and demographic factors.
system factors	system factors: functions/ features; system factors: non-functional characteristics; and system factors: challenges.
pedagogic factors	pedagogic factors: features; pedagogic factors: characteristics of online teaching; and pedagogic factors: challenges.
organisational factors	organisation factors: e-learning support; and organisation factors: challenges.
user difference factors	user difference factors: experience of online teaching; user difference factors: computer comfort level; and user difference factors: teaching style preference.
demographic factors	demographic factors: system experience; and demographic factors: level of study.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

This thesis focuses on the factors that influence virtual learning system (VLS) usage in South African residential institutions of higher education (HE). Usage pertains to the use of system functions/features by academics for online teaching and learning in higher education. In considering VLS usage in higher education, the researcher examined total system usage, extent and frequency of feature usage, as well as usage clusters employing the average frequency score as the main statistical measure. This study is multidisciplinary in nature, residing in the information systems discipline encompassing aspects of pedagogy and social psychology, and applies to the practice of e-learning in the higher education sector.

In the South African context, "higher education means all learning programmes leading to qualifications higher than Grade 12 or its equivalent in terms of the National Qualifications Framework as contemplated in the South African Qualifications Authority Act, 1995 (Act 58 of 1995), and includes tertiary education as contemplated in Schedule 4 of the Constitution" (Deaprtment of Education - South Africa, 2001:8).

Virtual learning systems refers to a class of software that are known by a number of names: course management systems (CMSs), learning management systems (LMSs), virtual learning environments (VLEs), online learning platforms, e-learning applications, and e-learning platforms. The term 'learning management system' was originally used to denote systems that were equipped to support many training courses of a short duration in the place of work intended to build knowledge for immediate applications. The term 'course management systems', on the other hand, was used to denote systems designed to support academic classes of a longer duration as education is planned around creating lasting knowledge (Carliner, 2005). However, there is an overlap in functionality between LMSs and CMSs, which explains why these terms have come to be used interchangeably. Recent literature shows a distinct trend to use the term "learning management systems" synonymously with the term "course management systems" because the latter has integrated e-learning capabilities, and are therefore, not strictly speaking to course management as its name suggests. Systems that were classified as course management systems are presently being referred to as learning/course management systems, or vice versa (Mcgee & Green, 2008). In this thesis, the *generic* term virtual learning systems (VLSs) will be used to describe the class of software designed for e-learning in higher education. Examples of VLSs in use are Blackboard, ATutor, and Moodle (Wcet, n.d.-a).

According to Meerts (2003), VLSs are becoming more sophisticated in their architecture and their feature set. VLS usage amongst academics in higher education is influenced in some measure by a number of actors, including system functions/features (Egert, Jacobs & Barnes, 2009), system non-functional characteristics (McGill & Klobas, 2009; Nanayakkara, 2007), pedagogical factors (Meerts, 2003), user difference factors such as computer self-efficacy (Al-Busaidi & Al-Shihi, 2010), comfort with information technology (Machado & Tao, 2007), teaching style (Al-Busaidi & Al-Shihi, 2010), user experiences such as instructor effort (Masrom, Zainon & Rahiman, 2008), effectiveness of the educational process and improved communication (Cavus & Momani, 2009), demographic factors such as experience with the use of technology (Al-Busaidi & Al-Shihi, 2010), and organisational factors (Nanayakkara, 2007). The system functions/features and the system non-functional characteristics, in particular have design implications that influence VLS adoption and usage, whilst the pedagogic, organisational, user difference, and demographic factors have feature usage implications that are beneficial to instructional designers/educational technologists, and managers of e-learning departments in higher education.

New educational technology services and features are driven by advances in technology and a growing market. Despite the adoption of VLSs by higher education institutions, academic usage of system features is limited. The gap between the VLS features available and those actually used for online teaching and learning are explored in this study. In addition, Jasperson, Carter and Zmud (2005:529) observed that "most researchers tend to study IT applications as a black box" rather than their specific feature sets. Towards addressing this gap, this study examines the collection of specific feature sets of VLSs in terms of what are deemed useful, what are actually used, and whether perceived usefulness of these feature sets is positively associated with VLS usage.

The hypothesis for this research is that a conceptual model representing the influence of factors on VLS usage in higher education can:

- Provide knowledge on functions/features for subsequent design and development endeavours of VLSs.
- Generate knowledge about the non-functional and interactive properties required for VLSs.
- Provide knowledge on pedagogic features to be considered for the design and usage of VLSs.
- Provide insights into the effect of organisational factors on system usage.
- Provide insights into the effect of user difference (system users) factors on system usage.
- Provide insights into the effect demographic factors on system usage.

The conceptual model representing the factors that influence VLS usage in HE can be used by:

- System designers to provide an evolved and updated VLS.

- Managers of e-learning departments to overcome organisational and user difference challenges and devise an enterprise-wide strategy for implementation and integration of VLSs into the university culture.
- Instructional designers and educational technologists to design standardised and customised training interventions to optimize system usage.
- Researchers for educational technology utilisation studies.

The background to the research problem is presented in section 1.2, followed by the problem statement and purpose of the study in section 1.3. The research questions that form the basis of this study are defined in section 1.4, with the rationale for the study discussed in section 1.5. The scope and limitations are discussed in section 1.6, and the research design is covered in section 1.7. In section 1.8, the significance and potential contribution of the study is addressed. The chapter concludes with a discussion of the thesis layout in section 1.9.

1.2 Background to the study

The arrival of the Internet and the World Wide Web revolutionised business, government, health, and educational practices, amongst others. The impact of these technologies is widespread and far reaching. Organisations are faced with the challenge of embracing technology or becoming obsolete by failing to exploit the benefits of technology. In education, these technologies have created new opportunities for teaching and learning, allowing educators to deploy new models of teaching, learning and administration. Universities and technical institutes in a developing country, such as South Africa, are faced with the challenge of adopting and embracing virtual learning systems to integrate e-learning. Virtual learning systems should allow these higher education institutions to stay abreast of latest educational technologies, to be competitive in the higher education domain and to afford their stakeholders new innovative ways of teaching and learning. Educational technology is advancing at a vast pace and institutions have to keep abreast or fall behind.

The South African government has acknowledged the role of information and communication technologies (ICTs) in transforming teaching and learning environments into an inclusive and integrated practice where learners learn collaboratively, engage in meaningful contexts and develop creative thinking and problem solving skills (Department of Education - South Africa, 2004). According to Kakasevski, Mihajlov, Arsenovski and Chungurski (2008:613), learners in higher education have the opportunity to participate in “active, independent, self–reflective and collaborative” modes of learning.

An implicit theoretical position underpinning the transformation of e-learning in higher education is based around social constructivism, communities of practice and learning networks (Wise & Quealy, 2006).

In higher education institutions, electronic teaching and learning environments, referred to as virtual learning systems in this study, have been adopted and are becoming increasingly popular among academics. Research studies have shown that there is an upward trend in the uptake of virtual learning systems in many institutions of higher learning, particularly in the United Kingdom, Europe and the United States of America. For example, in 2005, 95% of all higher education institutions in the United Kingdom (UK) were using a virtual learning system (McGill & Klobas, 2009). However, despite this ubiquity of VLS use, there has not been widespread change in pedagogic practice to take advantage of the functionality afforded by VLSs (McGill & Klobas, 2009). A 2001 survey done by the universities and colleges information systems association (UCISA) of VLS use in HE, indicated that 40% of the 89 institutions in HE included in the survey reported using a VLS (Britain & Liber, 2004). This was a dramatic improvement over the estimated 7% VLS use, four years previously. The greatest growth had taken place in 2000. By contrast, the 2003 managed learning environment (MLE) landscape report survey, which received returns from 358 institutions across both HE and further education (FE), reported a very high prevalence of VLS usage in all types of institutions surveyed. The MLE survey report revealed 85% of further education (FE) colleges, 84% of pre-1992 universities and 97% of post-1992 universities were using one or more VLSs in their institution. However, there is a gap in the literature with regard to the way that VLSs are being used within institutions to support teaching and learning functions (Britain & Liber, 2004). Therefore, given this high level of VLS uptake by institutions, the issues focused and reported on in this research are: how VLSs are being used within institutions to support teaching and learning functions, and what factors influence system usage?

1.3 Problem statement and purpose of this study

A problem can be defined as any situation where a gap exists between the actual and desired ideal states (Sekaran & Bougie, 2010). Currently, VLSs offer educators a variety of functions/features, which provide more opportunities for innovative educational application and increased use of the system. According to Hueh and Hsu (2008), studies focusing on the actual use of VLSs reveal that some functions are used more often than others. They presented the findings of a survey of 862 faculty members at 38 institutions that used Blackboard. They found that few faculty members used VLS functions to assess students or to promote community. Most faculty members used instructional functions, such as publishing syllabi, sending email, and providing readings. The communicative and interactive features were mostly unused. They suggest that it is possible to increase VLS usage by instructors by focusing on appropriate design of

VLSs, indicating that if VLSs support the work of instructors well, they will be used more. In another study conducted by the University of KwaZulu-Natal (UKZN) in South Africa (Jackson, n.d.), a review of the status of VLS implementations to fulfil current and future user needs was undertaken in 2007. An online survey was conducted at UKZN targeting current and potential VLS course developers. Thirty eight survey responses were received, of which four reported that they had not used a VLS before. Of the remaining 34 responses, 28 had used or were using the Online Learning System (OLS), two reported using Moodle and four reported using any other VLS. The VLS usage patterns were as follows: twelve (34%) used a full range of learning and communication tools; fifteen (44%) used some interaction and communication tools mainly for content distribution; 0% was reported for online marking and grading tools; and 21% was used for content distribution tools only. The results of the above-mentioned studies, illustrate an irregular pattern of functions/features usage, which is endorsed by Van der Valk (2008) that virtual learning systems hold real promise, but are unrealized in many cases.

Hence, the full potential of these technologies to support teaching and learning has not been fully realized, despite the existence of a proliferation of such systems and the benefits afforded.

According to McGill and Klobas (2009), there has been little research on the use of VLSs by instructors. Welle-Strand and Thune (2003) report that there is a lot of information about e-learning solutions, but knowledge of actual use is still limited in terms of what types of technology are used and how they are used. Much of the research on VLSs has a technology focus or is limited to studies of adoption based on the technology acceptance model (TAM) or unified theory of acceptance and use of technology (UTAUT) and its close variants, or extensions based on a *single reference* theory (Hueh & Hsu, 2008). In current literature, there is limited research on the factors that influence usage of VLSs from a multi-dimensional perspective encompassing functions/features of the system, the pedagogic aspects or the organisational support for online teaching and learning. Furthermore, the usability properties need to be examined since VLSs should allow both teachers and learners to “efficiently manipulate this interactive software, and should be appropriate for the intended learning task” (Ardito et al., 2005). The usability issue is emphasised by Costabile and Marsico (2005), who believe that the user interface of an e-learning system can pose problems if it is poorly designed with confusing menus, unclear buttons or illogical links. In addition, the role of the organisational context in which the system is embedded, and the role of system users on VLS usage need to be examined. Organisational support for system use (such as ease of access to the system, training, relationship of the user with support staff, etc.) can influence use, and therefore merits investigation. The significance of ‘facilitating conditions’ is reflected in Delone and McLean (2003) addition of ‘service quality’ to the revised model of IS success.

The objective of this research is to determine the influence of system, pedagogic, organisational, user difference and demographic factors (Markus, 1983) on VLS usage at residential institutions of higher education (HE).

The problem focuses on the lack of widespread acceptance and usage of the functions/features of e-learning tools and technology via the medium of VLSs in residential institutions of higher education to support teaching and learning activities/tasks, and management of courses. Is the problem of VLS usage related to a lack of buy-in, which should occur as a natural consequence of consultation with regards to educators' needs pertaining to the functions/features of e-learning systems, or is it related to other non-technical factors such as pedagogic, organisational, user difference and demographic factors?

The objective of this study is to identify the factors that influence educators' usage of VLSs at South African (SA) residential institutions of higher learning by examining:

- The extent and frequency of system feature usage, total system usage and usage clusters.
- System factors of functions/features corresponding to concomitant factors of perceived usefulness and perceived importance that influence actual system usage.
- Pedagogic factors that influence actual system usage.
- Organisational factors that influence actual system usage.
- User difference factors that influence actual system usage.
- Demographic factors that influence actual system usage.

The results of the outcome of these objectives could increase awareness of the potential and capabilities of e-learning systems to support teaching and learning activities, and lead to the design of virtual learning systems that fulfil academic needs.

1.4 Research questions

This research study was guided by the following main research question:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

In order to address the main research question, the following research sub-questions were derived:

1. What is/are the extent of usage, frequency of usage, total system usage, and usage clusters for VLSs in higher education?

2. What system factors corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?
3. What pedagogic factors influence actual system usage in higher education?
4. What organisational factors influence actual system usage in higher education?
5. What user difference factors influence actual system usage in higher education?
6. What demographic factors influence actual system usage in higher education?

1.5 Rationale (motivation for research)

The rationale for this study is presented from a personal, system, national, organisational and scientific perspective.

1.5.1 Personal rationale

Interest in this research topic stems from the personal experience of using both a commercial and open-source virtual learning system at a higher education institution.

1.5.2 System rationale

It is presently unknown whether the current functionality and system properties provided by virtual learning systems, implemented in South African residential HE institutions, support all the generic tasks that educators wish to perform, in the way that educators understand them and wants to perform them, and how this impacts VLS usage. Empirical studies are necessary and important in order to describe the relationship between required software support for teaching, learning, assessment and administrative tasks, and the level of functionality provided by VLSs as well as the interactive and quality properties of VLSs. Educators of a variety of disciplines need to be consulted with regard to how software can support and enhance the performance of teaching and learning tasks, in order for VLSs to achieve widespread acceptance and usage.

1.5.3 National rationale

The draft paper on e-education (Department of Education - South Africa, 2004) highlights the role of information and communication technologies (ICTs) in education. The South African government's policy on the use of ICTs in education is articulated as follows: "The introduction of information and communication technologies (ICTs) in education represents an important part of Government's strategy to improve the quality of learning and teaching across the education and training system. The policy intention is not just to build technical skills, but also to use ICTs to extend and enrich educational experiences across the curriculum. The objective is to build digital and information literacy so that all learners become confident and competent in using technology to contribute to an innovative and developing South African society" (Department of Education - South Africa, 2004:19).

One of the challenges cited in the white paper is "integration of ICTs into the learning and teaching process" (Department of Education - South Africa, 2004:8). This study addressed this challenge by reviewing issues of system usage and factors that could positively influence usage of VLSs for teaching and learning.

1.5.4 Organisational rationale

Higher education institutions (HEIs) implement VLSs with the intent to assimilate e-learning with face-to-face instruction and thereby derive associated benefits from their usage. However, the full potential of these systems can only be realised if VLSs meet the needs of users (educators and students) by providing usable tools suitable to facilitate teaching/learning, assessment administration, record keeping and course management. Missing functionality/tools can result in poor realisation of benefits, which, in turn, can result in limited success for VLSs.

There is limited knowledge of educators' perceptions on challenges or barriers to the success of online teaching and learning. Knowledge of faculty input on institutional support requirements for e-learning is limited, as is the impact of institutional support on usage. In addition, little is known about the influence of user (intended system users) characteristics and experiences on VLS usage.

This study addressed the above limitations by conducting an empirical study designed to elicit faculty input on: the usefulness of system functions/features for online teaching, the importance of non-functional characteristics, and support for pedagogic features, requirements for institutional support, user characteristics/differences and e-learning challenges. The relationship between these categories of factors and system usage are examined in this thesis.

1.5.5 Scientific rationale

The scientific rationale for this study is the need for identifying the components of a conceptual model representing the factors that influence virtual learning system usage in higher education.

1.6 The scope and context of the study

1.6.1 Scope of the study

This study augmented a technical analysis focusing on system functions/features by a social-technical analysis and organisational analysis. To this end, this study focused on multi-dimensional factors that influence VLS usage in higher education. The system factors examined were concerned with the technical functions/features and non-functional characteristics such as usability, reliability, security, robustness, etc. System-related factors of perceived usefulness corresponding to system functions/ features, perceived importance corresponding to non-functional characteristics, and system challenges were also considered in this study. The pedagogic factors included pedagogical features, characteristics of online teaching and pedagogic challenges. The organisational factors included institutional support for e-learning and organisational challenges. The user difference factors considered for the study were computer comfort level, teaching style preference and experience of online teaching. The demographic factors considered for the study were academic rank, system experience and level of study (i.e., undergraduate or postgraduate).

1.6.2 Limitations of the study

The study did *not*:

- Attempt to design or develop prototypes of VLSs, nor did it produce a specification for a target VLS.
- Focus on administrative features of a VLS that were targeted for system administrators.
- Focus on technical installation features that were targeted for technical operating personnel.
- Consider pedagogic factors related to discipline-specific needs or methods of teaching.
- Consider organisational factors pertaining to financial/budgetary constraints.
- Consider user characteristics such as gender, race, disability or age.
- Consider demographic factors such as lecturing experience, highest qualification, or pure distance learning.

The study interviewed and surveyed educators as the central agents of e-learning. Educators' experience and usage of only two VLSs namely, Blackboard and Moodle deployed at two higher education institutions formed the basis of this investigative study. Blackboard and Moodle were chosen as these VLSs are widely used by higher education institutions worldwide and are therefore, appropriate to use for this research. The two institutions studied were the Durban University of Technology (DUT) and the University of KwaZulu-Natal (UKZN). These two institutions were selected because they are residential universities, each representing a different character with DUT offering more 'experiential programmes' and UKZN offering more 'academic knowledge oriented programmes', hence embracing diverse university cultures. Accessibility was another reason for the researcher selecting these two institutions.

1.7 Research design

The study was conducted from the perspective of understanding virtual learning system usage in higher education by considering the influence of system factors corresponding to perceived usefulness and perceived importance, issues of the application domain, namely, pedagogic factors, organisational factors, user difference factors, and demographic factors aimed at educators who are the chief agents of e-learning. In particular, a multi-dimensional study was undertaken investigating the factors that influence VLS usage in higher education.

This section briefly introduces the research strategy/method used, data collection and data analysis techniques and model development.

1.7.1 Research strategy/method

A case study research strategy was deemed most appropriate for this study. Case study research is well suited to information systems (IS) research as the IS discipline is the study of information systems in organisations (Myers, 1997:7). The study was a two-case study design conducted at two residential higher education institutions namely UKZN and DUT to identify the factors that influence virtual learning system usage in higher education.

A scientific methodology for conducting case studies addressing issues such as generalizability, replicability, and controlled observations was followed. Details pertaining to the implementation of the case study design strategy, validity and reliability issues, data collection, analysis, triangulation, limitations and ethical procedures are presented in Chapter 5.

1.7.2 Data collection

1.7.2.1 Data collection methods

Research methods are frequently triangulated by multiple data collection methods. In this study, secondary data obtained from literature study and archival/written sources was triangulated with primary data obtained from focused interviews, and structured surveys (questionnaires).

A literature review was undertaken to establish an initial theoretical framework for the research study. The literature review helped to identify a list of the core generic functions/features for VLSs, non-functional system characteristics and the other non-technical factors that influence VLS usage. Secondary data in the form of the literature review and archival/written data sources on the relevant virtual learning system specifications (described in Chapter 3) was combined with primary data collection techniques which incorporated focused semi-structured interviews (refer to Appendix 1), and structured surveys (refer to Appendix 2).

1.7.2.2 Population and sampling

A purposive sampling technique was used to select potential participants for the focused interviews. According to Sekaran and Bougie (2010), purposive sampling is a popular technique in qualitative investigation where subjects are selected on the basis of expertise in the subject being investigated.

Interviews and surveys were conducted with academic staff from varying disciplines at UKZN and DUT to determine the following: usefulness of online tutoring and didactic functions/features of a VLS in support of pedagogic goals, missing functionalities or capabilities, importance attached to the quality or non-functional characteristics of a VLS, pedagogic features to be supported in a VLS, necessary institutional support for e-learning, and challenges of e-learning.

The interviewees and survey respondents were currently using VLSs, and had a minimum of one year's experience with using VLSs.

1.7.2.3 Ethical considerations

Ethical clearance was obtained from the relevant authorities before commencing with the collection of data. The identities of interviewees and survey respondents will not disclosed in this thesis or during the publication of the results of this research. An informed consent form, as suggested by Creswell (2009), was used for participants to sign before they engaged in the research.

1.7.3 Data analysis

Tagging was used to analyse qualitative data with the aid of the Nvivo tool (QSRInternational, n.d.). To explain the phenomenon of VLS utilisation in higher education, a set of themes were identified as a first step. This type of analysis is termed thematic analysis of qualitative data. These themes or categories, which are similar to the independent variables or factors used in quantitative research, were then correlated with actual system usage using a technique called cluster analysis. These analytical techniques are described in Chapter 5, and the results of the qualitative analysis are presented in Chapter 6.

Descriptive and inferential statistics were used to analyse the quantitative data. Descriptive statistics involve measures of central tendency, variation, and frequency tables. Inferential statistics involved the testing of research propositions and included reliability analysis and correlation analysis such as Pearson Product Moment correlation. The quantitative data techniques are described in Chapter 5, and the results of the quantitative analysis are presented in Chapter 7.

1.7.4 Model development

The outcome of the research was to identify and describe the components of a conceptual model representing the factors that influence virtual learning system usage in higher education. The body of knowledge produced from this research was integrated and presented as the Virtual Learning System Usage Model (VLSUM). VLSUM was developed using a combination of different system acceptance and usage models and the empirical results of this study. Three major components were identified and the factors comprising each component are described in Chapter 8, section 8.3. Relationships between components and among factors within each component are depicted Figure 8.1.

1.8 Significance and potential contribution of the study

The main contribution is the identification of the components of a conceptual model of factors that influence VLS utilisation in residential higher education institutions. The aim of this model is to enable the relevant stakeholders to identify the system, pedagogic, organisational, user difference and demographic factors that influence VLS usage in higher education.

Given the full scope and range of benefits to be derived from the successful use of VLSs to integrate e-learning in HE, a study of what factors contribute to, or detract from, the successful design and implementation of these systems would provide valuable insights to software designers/developers, when designing future versions of virtual learning systems, to managers of e-learning departments as well as to educational technologists, when implementing VLSs in higher education.

From a scientific perspective, this study added to the knowledge of user acceptance and usage models by testing assumptions of the underlying theories, replicating theories, synthesising theories from different fields and extending existing models, as discussed in Chapter 10.

The product contribution of this study involved the design of the following research instruments: the interview schedule, the questionnaire and model confirmation interview (refer to Appendices 1, 2 and 3).

1.9 Outline of this study

The study is organized into 11 chapters. The outline of this thesis is depicted in Figure 1.1. Chapter 1, the introduction, provides an overview of the research including the background, research problem, research questions, rationale, scope, research method and design, and potential contribution of the study. Chapter 2 provides a comprehensive review of the literature on the evolution of virtual learning systems, the online tutoring and didactic functions/ features and non-functional characteristics to be integrated in a VLS, as well as VLS usage by educators to integrate e-learning in higher education. Chapter 3 provides a description of the functions/features and non-functional characteristics supported by the two virtual learning systems under study, namely, Backboard and Moodle. Chapter 4 discusses relevant theories, models, and pedagogic, organisational and user difference factors, which influence the VLS utilisation in higher education. Chapter 5 discusses the research design and methodology for the study, including philosophies, research methods and strategies, data collection and data analysis techniques and the research design used for this study. Chapter 6 presents the results and qualitative analysis of the results from interviews conducted at DUT and UKZN to determine the major themes/subthemes and relationships thereof pertaining to virtual learning system usage in higher education. Chapter 7 presents the results and quantitative analysis of results from verification surveys administered at DUT and UKZN to determine the factors that influence virtual learning system usage in higher education. The Virtual Learning System Usage Model (VLSUM) proposed for explaining VLS usage in higher education is presented in Chapter 8. Chapter 9 discusses the process followed for confirmation of the VLSUM together with the results of the confirmation process. Chapter 10 discusses the scientific and product contributions for the study. Chapter 11 concludes with a summary of the research undertaken, and provides methodological and scientific reflections, as well as recommendations for future research.

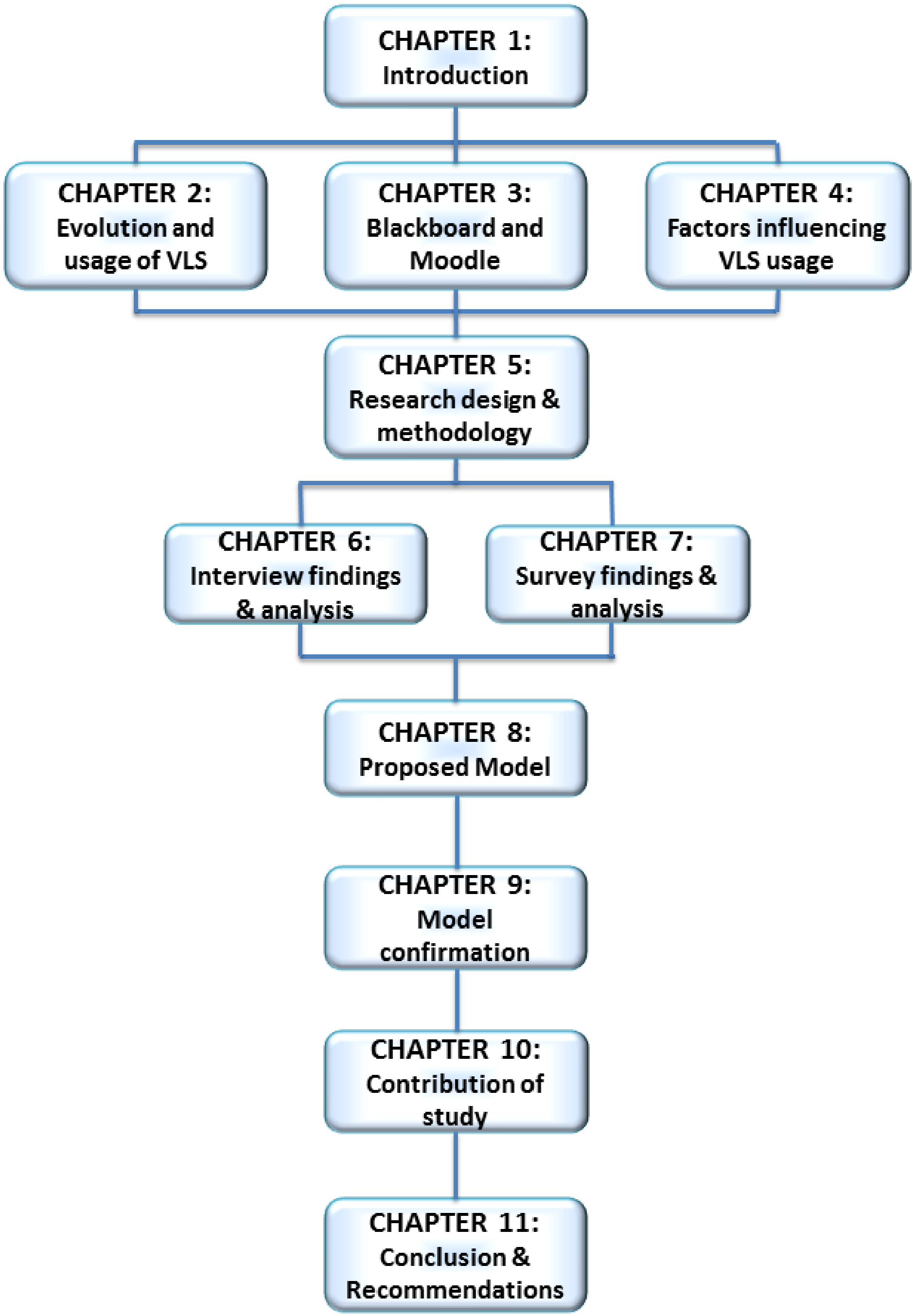

Figure 1.1: Thesis Map

CHAPTER 2: EVOLUTION AND USAGE OF VIRTUAL LEARNING SYSTEMS

2.1 Introduction

The purpose of this chapter is to present a comprehensive review of relevant literature to understand the evolution of e-learning technology, the functions/features of a class of software known as virtual learning systems (VLSs), and its usage by educators to integrate e-learning in higher education. The literature review covered in Chapters 2, 3 and 4 collectively demonstrate the motivation for research questions outlined in Chapter 1 and confirm the research topic for this study. The literature review included an overview of appropriate theories, and informed the design of research instruments to be used for the empirical part of the study. The literature survey indicated gaps that justify the need for a multi-perspective factor analysis of the phenomena of VLS usage in higher education. Existing literature does not examine the influence of multiple factors namely system factors corresponding to perceived usefulness and perceived importance, pedagogic, organisational, user difference and demographic factors on VLS usage in higher education. Hence, a technical analysis of virtual learning systems augmented by a social-technical and organisational analysis is deemed necessary in order to understand the influence of multiple factors on VLS usage in higher education.

In section 2.2 of this chapter, e-learning and VLSs that form the focus of this investigation are defined and contrasted with related technologies together with trends in the field of e-learning. Section 2.3 describes VLS design features as well as online tutoring and didactics functions/features to be integrated in a VLS. Section 2.4 provides a discussion on faculty usage of a VLS in higher education. Section 2.5 discusses implications of system factors for VLS usage in higher education followed by a summary of the chapter in section 2.6.

2.2 Developments in the field of e-learning

A proliferation of educational tools for online education has led to a growing interest among educators to experiment with these tools in online courses (Cavus & Momani, 2009). Virtual learning systems are a newer breed of educational technology comprising tools for teaching and learning designed to improve the students’ learning experiences (Cavus & Momani, 2009). The choice of options that facilitate learning is increasing as a result of the availability of a wide range of information and communications technologies (Blinco, Mason, McLean & Wilson, 2004). Technology plays the role of enabler of learning and of creating connections (Elearnspace, n.d.). This section covers the definition of e-learning, classification of e-learning technologies and trends in e-learning environments.

2.2.1 Definition of e-learning

The IDC definition of e-learning is “the enablement and delivery of asynchronous or synchronous education and training content (e.g. multimedia presentation, simulations, and assessment) over an intranet, extranet, or the Internet to an end-user device” (Brennan, Funke & Anderson, 2001:11). This definition views e-learning as a subgroup of technology-based training (TBT) comprising CD-ROM and other forms of technology mediated training formats. TBT, in turn, is viewed as a subgroup of all forms of training, encompassing instructor-led training (ILT) and text-based training. Tavangarian, Leypold and Nölting (2004:274) define e-learning as “all forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to individual experience, practice and knowledge of the learner”. This definition is based on the constructivist learning model. According to Naidu (2006:11), e-learning refers to “the intentional use of networked information and communications technology in teaching and learning”.

Gonella and Pantò (2008) provide the following differentiation of the didactic models e-learning 1.0, on-line education and e-learning 2.0. E-learning 1.0 is based on learning management system (LMS) technology used for content delivery, training, enrolments, progress monitoring and certification. The main strength of these e-learning systems is the simplification of the administration and management of courses and users. The producers and users of these platforms do not give much attention to communication, collaboration, knowledge creation and active learning. Instead, attention is focused on content in the form of interoperable and re-usable learning objects complying with the SCORM standard, while the learning process is undervalued (Gonella & Pantò, 2008). Online education refers to “educational practices based on communication and collaboration, with the use of web-based training “programs” (Gonella & Pantò, 2008:3). It is more widespread in universities. The technologies used are CMSs and collaborative tools. This model focuses on a range of content such as books, readings, lecture material etc. selected by the lecturer as well as learning activities and discussion forums, which actively engage students (Gonella & Pantò, 2008). The term e-learning 2.0 evolved as a result of the dissemination of "social software", which changed the manner in which the internet is used for knowledge and communication. The web technology is used as a platform. In addition to users’ contributions to newsgroups and forums, most websites allow for users to produce their own content. The usage/creation process is constant and the availability of multiple channels and wireless connections enable users to be always online. These new web usage practices have influenced the e-learning framework (Gonella & Pantò, 2008).

2.2.2 Classification of e-learning systems

According to Ellis (2009:1), a learning management system (LMS) is a "software application that automates the administration, tracking, and reporting of training events". The LMS must have administrator tools (manage user registrations and profiles, define roles etc.); content access, development and integration (support for a third party software) services; skills assessment and management capabilities (learners assess their competency gaps); assessment capabilities; adherence to standards such as SCORM; and security such as passwords and encryption (Ellis, 2009; Wyles, 2004). The didactic model e-learning 1.0 proposed by Gonella & Pantò (2008) is based on learning management systems (LMSs).

Course management systems, on the other hand, are mainly used for online or blended education, by supporting the posting of online course materials; linking students to courses; tracking students' progress; storing students' assignment submissions and facilitating the lecturer-student communication (Watson & Watson, 2007). Course management systems fit the didactic model of "online education" proposed by Gonella & Pantò (2008). According to Szabo and Flesher (2002), a LMS, on the other hand, is characterized as systemic in that it is "the infrastructure that delivers and manages instructional content, identifies and assesses individual and organisational learning or training goals, tracks the progress towards meeting those goals, and collects and presents data for supervising the learning process of an organization as a whole" (Watson & Watson, 2007:28). Horton and Horton (2003) add to this description by stating that learning management systems work mainly at the curriculum level, tracking what courses learners have taken. In contrast, a CMS "provides an instructor with a set of tools and a framework that allows the relatively easy creation of online course content and the subsequent teaching and management of that course including various interactions with students taking the course" (Meerts, 2003). LMSs are more typically utilized in corporate settings using many available systems on the market (Carliner, 2005:4).

A learning content management system (LCMS), in contrast to a LMS and CMS, is defined as a system used to build, store, collect, manage, deliver and reuse e-learning content in the form of learning objects, namely, media, pages, tests, lessons and other components of courses using a central object repository (Brennan et al., 2001; Horton & Horton, 2003; Watson & Watson, 2007; Wyles, 2004; Solemon & Sulaiman, 2006). A LMS, in contrast to a LCMS, is "learner and organization focused; it is concerned with the logistics of managing learners, learning activities and the competency mapping of an organization" (Watson & Watson, 2007:30). While LCMSs are different from LMSs, they complement each other (Brennan et al., 2001). A LMS can combine courses created with web-based and course authoring tools as well as integrate courses delivered by a learning content management tool (LCMS) (Horton & Horton, 2003; Neal & Miller, 2005).

In summary, learning management systems (LMSs) were designed and equipped to support training courses of a short duration while course management systems were designed to support academic classes of a longer duration (Carliner, 2005). However, both LMSs and CMSs were designed to support e-learning and the terms being used to describe these systems have come to be used synonymously. A LCMS focuses on the design, delivery and management of learning objects using a central objects repository, which can be used to complement the functionality of both LMSs and CMSs. In this thesis, the generic term virtual learning system is used to describe the class of software designed for e-learning in higher education.

2.2.3 Trends in e-learning technologies

Meerts (2003) acknowledged that VLSs are becoming more sophisticated in their architecture and their feature set and highlighted three trends, which show how VLSs are evolving. Some of the trends highlighted by Meerts (2003) are as follows:

- The change to a more open systems architecture paving the way for a marketplace of third-party tools that could be incorporated as modules into the main system. Some institutions expressed the idea of an ideal VLS, which would allow them to adopt a best-of-breed approach whereby they can easily plug-in to their VLS the specific tools and practices they prefer. Towards this end, the Open Knowledge Initiative (OKI) defined an open and extensible architecture for educational technologies by specifying how the technology components communicate with each other and other campus software (Gallagher, 2003). According to Britain and Liber (2004), the major VLSs were following this trend by allowing third party developers to develop modules that could be integrated into their systems. Hence, the VLS was similar to a framework where educational tools were developed independently.
- Seamless integration with other major university information systems, for example, the student record system (SMS), the university website and the library system.
- The ability to import curriculum materials developed by educational and academic publishers into virtual learning systems. According to Blinco et al. (2004:4), publishers were offering value-added services such as ‘McGraw-Hill’s PageOut and Thomson Learning’s TextChoice’, which provided access to digital content that can be customized by lecturers.

Blinco et al. (2004) makes the observation that e-learning currently encompasses an increasingly wide scope of applications and activity, resulting in an evolving e-learning landscape, which are shaped by the following factors:

- The advent of “learning ware”, which is smaller more focused modules, as opposed to the traditional course model (courseware). Gallagher (2003) noted the rise of learning objects, which have the potential to shape the future of VLSs. A learning object is a small unit of standalone learning content that is reusable and tagged with a description indicating what the object is and allowing it to be easily retrieved in a search. According to Vovides, Sanchez-Alonso, Mitropoulou and Nickmans (2007), a VLS incorporating learning objects with attached metadata and intelligent tutoring functionalities is both beneficial and useful to users.
- Portals are widely adopted in e-learning. According to Britain and Liber (2004), there is a movement towards a component-based approach where a virtual learning environment is combined with other components such as a portal, an intranet, a content management system, an MIS system etc. to create a managed learning environment. Neal and Miller (2005) advocated learning portals and learning communities as a way of merging informal and formal learning using a virtual classroom for interactive learning and knowledge management techniques for finding and sharing knowledge. “Portal Web Services provide a rich set of standards-based web services that can act as a standalone portal or as a feed to multiple institutional portals on and off campus” (Blackboard Inc., n.d.:9).
- “M-learning” or mobile learning, which has an influence on the design of e-learning content and applications.
- Acquisition and sharing of metadata and content is taking place across distributed infrastructures and multiple repositories.
- Activity-based learning applications are emerging in the market where processes, namely, activities, interaction sequences, and workflow as well as content are given equal consideration. According to Britain and Liber (2004), there are tools that can be deployed by educators to design learning activities within e-learning systems.
- Mind-mapping software, which allows ideas and information to be organized are being marketed to educators.
- Discovery and mining of learning objects, which are made possible by query interfaces.
- The adoption and use of service-oriented approaches and toolkit and lightweight development environments by individual innovators to produce standard compliant light applications.

E-learning trends highlighted by Downes (2005) are as follows:

- Trends that are manifest in learning are what are sometimes called "learner-centred" or "student-centred" design.
- File-sharing trend, which has led to free and open-source software, license for content, namely, creative commons, and open access to academic works.
- Another trend is that the web changed from being a transmitter and consumer of information to a network model where content is developed, changed, shared, and distributed (Downes, 2005).
- The blog very quickly became a global phenomenon with tools such as the Blogger and WordPress. Blogs were connected to each other through the mechanism of Really Simple Syndication (RSS). An e-learning application resembles a blogging tool in that it acts as a node in a web of content, which is linked to other nodes and content creation services. It acts as a student learning centre, where content is selected, reused and adapted as needed. It also acts as a personal portfolio tool to create and showcase a student's work.
- Enterprise learning-management systems will give way to a connected set of open-source applications. The e-learning framework is an example of such an initiative where work on a set of common applications is currently underway. While these systems continue to offer content delivery, its services will be more platform-based rather than application-based and its design will extend to include learning activities.

Other trends followed in the wake of social networks and the development of immersive virtual learning environments, which are as follows:

- Social networking applications such as Facebook, Twitter, and Flickr are being explored for educational applications (Flickr, n.d.); (Facebook, n.d.).
- A new form of virtual learning environment has emerged, which bears some similarity to VLSs but offer vastly different capabilities. The second life (SL) system, developed by Linden Lab is a persistent three dimensional world, which allows users to access the online system and interact with content and other 'residents'. Specific features include tools for constructing three dimensional objects and scripting tools for interactive content and connectivity with external web-pages and internet resources. SL affords teachers the "freedom to weave their own metaphors and build domain-specific settings in three dimensional environments. Currently, education designers in SL create all manner of classrooms, lecture halls and campus landmarks" (Kemp & Livingstone, 2006:22). Objects respond to commands allowing basic teaching agents to answer questions and distribute domain content (Kemp & Livingstone, 2006). According to Van der Valk (2008), virtual environments such as Second life have great potential for educational institutions in that they can provide many options for collaborative learning, learning

communities, virtual training and possibilities for experiential learning and prior learning assessment.

It is possible that VLS hosted classes will expand their reach to embrace the web 2.0 platform. The influence of the web 2.0 platform is evidenced by the development of wiki and blog plug-ins for the Blackboard and Moodle virtual learning systems. The connection between VLSs and web 2.0 can be seen with the advent of tools by which VLS users can publish micro content to the open web. An example of such services is “Blackboard’s Scholar.com” (Alexander, 2008:200).

2.3 Virtual learning systems for online education

This section covers the design, functions/features and properties of virtual learning systems, non-functional system characteristics, and non-functional system challenges.

2.3.1 VLS Design

A VLS is a web-based application which runs from a browser. The software should be able to be run from a remote client machine with an Internet connection (Sachan, 2006). According to Wyles (2004b), scripting languages such as PHP, Java server, OPenACS and AOL Server have been used for the development of a number of open source virtual learning systems. The common databases used for these open source VLSs are MySQL or PostgreSQL. Most of these web based technologies and services are free and meet the world wide web consortium (W3C) standards (Kalinga, 2008).

Open-source systems considered are covered by the General Public License (GNU), one of the founding open source licenses (OSL), and is open source initiative (OSI)-certified (Wharekura-Tini & Aotearoa, 2004). Open-source virtual learning systems deliver software with the source code, and the license agreement gives the licensee the right to modify and redistribute the software In addition to open-source VLSs, commercial packages such as Blackboard are also available.

One of the pressing design issues related to virtual learning systems is accessibility problems for teachers and students with disabilities (Cannect, n.d.).

2.3.2 VLS functions/features for online tutoring and didactics

According to Jasperson et al. (2005), most researchers tend to study IT applications as a black box rather than as a collection of specific feature sets. It was towards addressing this gap, that a literature study was conducted of the functions/features of VLSs, as well as of closely related and emerging technologies to compile a collection of feature sets for an updated and improved VLS.

Table 2.1 represents a synthesis of existing VLS functions/features, and the functions of closely related technologies such as LCMS and web 2.0 tools. The table is divided into different sections, with each section giving information on the respective tool functions/features, definitions, and tool properties. Section A discusses communication tool functions/features covering discussion forums, discussion management, electronic file exchange, internal mail, online journal/notes, real-time chat, whiteboard, announcements, wikis, audio and video conferencing, and virtual worlds. Section B discusses student productivity tool functions/features covering bookmarks, calendar/progress review, searching and filtering within a course, work offline/synchronize, orientation/help, and personal development planning (PDP). Section C discusses student involvement tool functions/features covering group work, community networking, and student profiles/portfolios. Section D discusses course administration and management functions covering authentication, course authorization, registration integration with enrolment records, and course management. Section E discusses assessment /progress tracking and reporting functions covering test types, automated testing management, online marking tools, online grade book, student tracking, assignment-specific digital drop boxes, and surveys. Section F discusses content authoring, delivery and management functions covering content authoring, content sharing/reuse, course templates, content-delivery and content and file management.

Table 2.1: Evolving online tools, functions and properties for VLSs

A. Communication tool functions	Definition	Communication tool properties
Discussion forums	A discussion forum in an online course is a threaded text conversation between course participants(Wcet, n.d.-b). A discussion forum is an asynchronous communication method whereby participants can have formal topic-related discussions as well as informal interactions (Neal & Miller, 2005).	The following discussion forum properties should be included in a VLS (Wcet, n.d.-a; Oliver, 2001; Sachan, 2006; Neal & Miller, 2005): • Create forum types (e.g. general and learning forums). • Subscribe to forums. • Post to forums. • View online discussions by date, thread, or post. • Expand or collapse discussion threads. • Search discussion threads. • Include URLs and file attachments in forum postings. • Integrate a formatting text editor for mathematical equations. • Include a spell-checker. • Allow or stop posts to be sent to students' email addresses. • Allow students to subscribe to RSS feeds. • Inform via e-mail when new posts are made. • Organise or sort postings by "date, title, author, group, or by specific topics" selected by the lecturer or other users.
Discussion management	Discussion management involves the accessing and scheduling activities associated with running a discussion forum" (Wcet, n.d.-b).	The following discussion management properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004) : • Allow students to create discussion groups. • Moderate discussions by screening of posts. • Peer-review posts by fellow students. • View statistical summaries of discussions displaying student participation for grading purposes. • Have discussions across courses and departments.
Electronic File exchange	File exchange tools allow for files to be uploaded from local computers and shared with lecturers or other students in an online course (Wcet, n.d.-b).	The following file exchange properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Neal & Miller, 2005): • Students can use drop boxes to submit assignments. • The contents of students' personal folders can be shared. • Group file sharing. • Student file-sharing.

Internal mail	Internal email is the sending and reading of electronic mail from inside an online course (Wcet, n.d.-b). E-mail is used to exchange resources (e.g., draft versions of documents, web links) for group work and for communication interchange between lecturers and students (Neal & Miller, 2005).	The following internal mail properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Wan et al., 2005): • Internal email facility whereby students can email individual members or a group. • An address book facility for students. • Instructors can e-mail an entire class at once. • E-mail messages can contain URLs, file attachments and HTML.
Online Journal/ Notes	Online Notes/Journal allows for students to make personal or private journal notes. Personal journal entries can be shared with the lecturer or other students. Private journal entries cannot be shared (Wcet, n.d.-b).	The following online journal/note properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004): • Make private course-related note entries.
Real-time chat	Real-time chat is a conversation that takes place over the Internet and involves an exchange of messages between participants at virtually the same time (Wcet, n.d.-b; Oliver, 2001). Instant Messaging (IM) occurs between pairs of individuals, while chat tools accommodate larger groups (Neal & Miller, 2005).	The following real-time chat properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Neal & Miller, 2005): • Support real-time group discussions. • Students can create new chat rooms. • Lecturers can manage chats and bar students from the chat rooms. • Polling capability and space where students can “raise their hands”. • Maintain a conversation log / archive logs for all chat rooms. • Instant Messaging (IM) between pairs of individuals. • Provide private messaging. • Exchanging files or URLs. • Chats histories should remain available for review for the duration of the course. • Instructors should be able to view time-stamped chat logs for assessment purposes. • ‘Who’s online’ facility to notify users who else is online when they are online.

Whiteboard	"Whiteboard tools include an electronic version of a dry-erase board used by instructors and learners in a virtual classroom (also called a smart board or electronic whiteboard) and other synchronous services such as application sharing, group browsing etc." (Wcet, n.d.-b).	The following whiteboard properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Neal & Miller, 2005): • Support image and PowerPoint uploading. • Support mathematical symbols. • Supports freehand writing and drawing. • Support group web browsing. • Support application desktop sharing. • Archive recordings of whiteboard sessions. • Support graphing and polling.
Announcements	An announcement tool allows lecturers to create and send text messages to class members (Blackboard Inc., 2006).	The following announcements tool properties should be included in a VLS (Blackboard Inc. ,2006; Wan et al., 2005): • Post bulletin board announcements to the class. • Create, edit, preview, sort and delete announcements.
Wikis	"A wiki is a collection of collaboratively authored web pages" (Cole & Foster, 2007: 157).	The following wiki tool properties should be included in a VLS (Augar, Raitman & Zhou, 2006; Cole & Foster, 2007): • Create wiki pages. • Edit wiki pages. • View wiki pages. • Remove orphaned wiki wages. • Manage wiki settings. • Override locked wiki pages. • Authentication so that wiki edits can be traced back to the author for assessment process. • Tracking to ensure that wiki content is not misused and intentionally deleted.

Audio and Video Conferencing	Audio conferencing, using the telephone or voice over Internet protocol (VoIP), allows a group to interact in real time by sharing voice (audio) (Neal & Miller, 2005). Videoconferencing extends audio conferencing capability by including video (Neal & Miller, 2005). Web conferencing combines many of the above synchronous technologies into one package, using either the telephone or VoIP for audio (Neal & Miller, 2005).	The following audio and video conferencing tool properties should be included in a VLS ("Elluminate Live!: Elluminate," n.d; Disbrow, 2008:227): • "Synchronous audio, video, whiteboard, graphic slide presentation, chat, application sharing, polling and emoticon responses". • "A recording function enables a session to be replayed at a later time for those participants who are unable to attend the live session".
Virtual worlds	"Virtual worlds take IM and chat into a visual realm, where avatars, or presentations of people, move in a two- or three dimensional world and talk to each other" (Neal & Miller, 2005).	Virtual world capabilities should be integrated into a VLS. Tool properties deemed useful are (Egert et al., 2009): wider ranges of identity and avatar use.
B. Student productivity tool functions/features	**Definition**	**Description of student productivity tool properties**
Bookmarks	Bookmarks allow students to go directly to pages within their course or outside their course on the web. In some cases, bookmarks are set for a student's private use, whereas, in other cases, bookmarks can be shared with a lecturer or a group (Wcet, n.d.-b).	The following book mark properties should be included in a VLS (Wcet, n.d.-a; Blackboard Inc., 2006; Botturi, 2004): • Students can add bookmarks to recurrently-viewed content items. • Edit, re-arrange, hide or show, and delete bookmarks.
Calendar/Progress Review	Calendar/progress review tools permit students to do course planning and enter submission dates for assignments (Wcet, n.d.-b).	The following calendar properties should be included in a VLS (Wcet, n.d.-a; Egert et al., 2009; Sachan, 2006; Botturi, 2004): • Instructors to post events in the online course calendar. • Add/ show assignments due dates, quiz and exam dates. • Add user (private), group (viewable by group only), or course events (viewable by entire class). • Allow users to view previous or future months.

		• Enable students to record their course plans and the associated assignments. • Use colour schemes to highlight important events. The following progress review properties should be included in a VLS (Botturi, 2004; Neal & Miller, 2005; Wcet, n.d.-a; Kalinga, 2008): • View grades on completed assignments, total points possible, course grade, and compare individual grades against the class performance. • Subscribe to RSS feeds for notification of changes to learning materials. • Indicate to the students what they have done/what they should do next. • View self-test performance report.
Searching and filtering within a course	Searching within a course allows students to find course material based on key words (Wcet, n.d.-b).	The following searching and filtering within a course properties should be included in a VLS (Wcet, n.d.-a): • Allow users to find/ retrieve learning material based on key words. • Allow students to search discussion threads; chat session recordings.
Work Offline/ Synchronize	Work offline/synchronize permits students to download course content to their local computers and work offline in their online course and for their work to be synchronized into the course the next time they logged into the system (Wcet, n.d.-b).	The following work offline/synchronize properties should be included in a VLS (Wcet, n.d.-a): • Ability to download the content for an entire course into a format that can be printed or stored locally. • Save course content to a CD-ROM that can be dynamically linked from within the online course or viewed offline. • Download course content and discussion group content with a PDA.
Orientation/Help	Orientation/Help tools help students to learn to use the VLS. These tools include self-paced tutorials, user manuals, email or telephone helpdesk support (Wcet, n.d.-b).	The following orientation/help properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Kalinga, 2008): • Online tutorials for students. • Context sensitive help for tools.
PDP	Personal development planning tools.	The system should incorporate (Wyles, 2004b): • Personal development planning (PDP) tools. • A time management tool for learners.

C. Student Involvement tool functions/services	Definition	Description of student involvement tools properties
Group work	Group Work involves organising a class into groups and providing group work space to permit the lecturer to assign specific group tasks or projects (Wcet, n.d.-b).	The following group work properties should be included in a VLS (Wcet, n.d.-a; Oliver, 2001): • Access to group work areas. • Assign students to groups. • Randomly create groups of a certain size or create a fixed number of groups. • Students can choose their own groups. • Group discussion forums. • Group chat or whiteboard. • Group-specific assignments or activities. • Private or monitored groups.
Community networking	Community networking tools allow students to form study groups, or collaborative teams without lecturer intervention (Wcet, n.d.-b).	The following community networking properties should be included in a VLS (Wcet, n.d.-a; Wyles, 2004b): • Student ability to form online clubs, interest, and study groups at the system level. • System-wide chat rooms or discussion forums.
Student profiles/ portfolios	Student portfolios are areas where students can showcase course artefacts, display personal photos, and demographic information (Wcet, n.d.-b).	The following student portfolios properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004; Barron, 2003): • Ability to create a personal home page listing all enrolled courses, email and course and system-wide events. • Students can create a portfolio of their work. • A student presentation area is needed to provide server space for students to upload projects, manage their files, edit their documents and showcase their work to the class. Can also be used to upload papers for class members to read and critique. • Allow the learners to restructure the presented material, add resources of their own, annotate material, launch and run simulations etc.

D. Course administration and management	Definition	Description of course administration and management properties
Authentication	"Authentication is a procedure that works like a lock and key by providing access to software by a user who enters the appropriate user name (login) and password." Authentication is also the process of creating and maintaining user names and passwords (Wcet, n.d.-b).	The following authentication properties should be included in a VLS (Wcet, n.d.-a; Kalinga, 2008): • Allow guest access to all courses. • System authentication against an external LDAP server. • User-authentication to prevent illegal access to information.
Course authorization	"Course authorization tools are used to assign specific access privileges to course content and tools based on specific user roles, e.g., students, instructors, teaching assistants. For example, students are assigned viewing rights, whilst lecturers are given authoring rights (Wcet, n.d.-b).	The following course authorization properties should be included in a VLS (Wcet, n.d.-a; Kalinga, 2008; Elementk, 2003): • Restrict access based on user roles. • Assign different roles to instructors or students in courses. • Grant users' rights or privileges. • Controls whether only logged in users or logged in and enrolled users have access to course content.
Registration integration	Registration tools are used to register and de-register students from an online course. Administrators and/or instructors use registration tools but students are allowed to use them when self-registration is available (Wcet, n.d.-b).	The following registration integration properties should be included in a VLS (Wcet, n.d.-a; Botturi, 2004): • Manually enrol students to courses or allow students to self-register. • Allow registration and particulars updates of users to the system. • Upload students in a batch to the system using a delimited text file. • Transfer student information bi-directionally between the system and an SIS using delimited text files.
Course management	Course management tools allow lecturers to control the activities of an online class (Wcet, n.d.-b)	The following course management properties should be included in a VLS (Botturi, 2004; Wcet, n.d.-a; Sachan, 2006; Brooks & Kettel, 2005; Kalinga, 2008; Wyles, 2004b): • Teachers can create and manage groups. • Sort class lists. • Generate reports. • Allow lecturers to create, migrate, and archive courses. • Manage student records, courses, students' progress and learning objects. • Selective release where lecturers can create custom learning paths by determining

		when students can access content items, discussions, assessments, assignments or other learning activities. • Availability rules to indicate what constraints (e.g. objective met, time limit exceeded, learning object attempted, current date and time etc.) must be met before the learning activity should be rendered as “visible” to the learner. • Hide resources: teachers can hide/show resources. • Reporting should be available at the programme management level – i.e. programme managers have access to drill down into the courses level. • Handle system database backups and system database restoration/recovery.
E. Assessment/ progress tracking and reporting	**Definition**	**Description of assessment/ progress tracking and reporting properties**
Test types	Test types refer to the types of questions that can be set using the system (Wcet, n.d.-b).	The following test types should be included in a VLS (Wcet, n.d.-a): • Measuring student performance in multiple ways by supporting multiple test types namely, multiple choice questions and answers; matching; ordering; jumbled sentence; calculated; fill-in the blanks; short answers; survey questions; essay. • Questions can contain other media elements (images, videos, audio).
Automated testing management	Automated testing management provides the ability to control when and where tests are taken and under what conditions (Wcet, n.d.-b).	The following automated testing management should be included in a VLS (Wcet, n.d.-a; Oliver, 2001; Sachan, 2006; Wyles, 2004b; Botturi, 2004; Elementk, 2003; Barron, 2003): • Create, edit, distribute, and deliver assessments. • Scramble test questions and answers. • Allow lecturers to create self-assessments. • Allow lecturers to set a time limit on a test. • Allow lecturers to select multiple attempts on self-tests while maintaining a record of all attempts. • Allow students to review past attempts of a quiz. • MathML editor for adding mathematical formulas in both questions and answers. • Allow lecturers to select whether correct results are shown as feedback. • Automatic scoring of quizzes. • Ability to add images, audio, video etc. to test questions. • Allow lecturers to create survey and/or poll questions. • Analyse survey data. • Show instructor feedback with links to relevant course material for review and

		remediation to items missed on exams. • Allow lecturers to set password controlled access to tests. • Allow lecturers to create tests based on specific topics, lessons, or an entire course. • Allow lecturers to create a question database that the system can randomize to create a unique self-assessment for each student to help to avoid cheating and passing along of test items. • Allow lecturers to import questions from existing test banks. • Allow lecturers to weigh tests and create their own grading rules. • Allow lecturers to set assessment submission options to notify which assessments have been completed, which need review or grading, and which have not yet been submitted. • Provide lecturers with a report displaying number of attempts and time per attempt on each assessment for each student. • Record options such as "highest score", "latest score," or "average score". • Allow lecturers to reset a student's quiz grade without changing other students' grades. • Enable lecturers to change a quiz item without erasing student scores. • Permit anonymous answers to surveys. • Ability to connect a self-test to a content module.
Online Marking Tools	Online Marking Tools allow lecturers and teaching assistants to assess student work online (Wcet, n.d.-b).	The following online marking tools properties should be included in a VLS (Wcet, n.d.-a): • Allow lecturers to assess paragraph questions. • Assess and load marked assignments through the assignment drop box. • Give assignment feedback through annotations. • Allow lecturers to publish student submissions as examples.
Online Grade book	Online grade book keeps track of student marks and graded online activities, with the added capability of assigning course grades (Wcet, n.d.-b).	The following online marking tools properties should be included in a VLS (Wcet, n.d.-a; Oliver, 2001; Barron, 2003; Sachan, 2006; Brown & Peterson, 2008): • Automatically add set assignments to the grade book. • Manually add students' marks for offline assignments. • Add details to custom columns in grade book. • Export grade book marks to an external spreadsheet. • Allow lecturers to create a course grading scale using percentages, letter grades, or pass/fail metrics. • Maintain electronic grade books. • Allow lecturers to manage grades online.

		• Save student performance results, including support for custom grading scales, grade weighting, item analysis and multiple grade book views. • Include formulas to automatically determine grades. • Ability to carry out complex calculations and weigh and assess different pieces of work.
Student Tracking	Student tracking helps to track aggregate and individual course material usage by students, and perform additional analysis and reporting (Wcet, n.d.-b)	The following student tracking tools properties should be included in a VLS (Wcet, n.d.-a; Wan et al., 2005; Botturi, 2004**;** Sachan, 2006; Kalinga, 2008): • Get reports on the time, date and frequency of aggregate and individual student access to specific course content items. • Display usage data, including file usage for an entire course in terms of who used what content and when. • Indicate whether students have reviewed, and the time spent on specific content units, lessons, assignments, and assessments. • View the summary of all discussion posts by students. • Analyse and report on aggregate and individual usage.
Assignment-specific digital drop boxes	Online student submission of assignments using a drop-box.	The following assignment tool properties should be included in a VLS (Barron, 2003; Botturi, 2004; Sachan, 2006): • Assignments submission: a "homework drop-box" facility. • Link assignments to specific lessons or course units. • Allow lecturers to determine if an assignment is a mandatory reading assignment, homework, project (individual/group). • Allow lecturers to determine whether or not the assignment is to be graded/non-graded, if it is for extra bonus points. • Allow lecturers to create individual assignments, group assignments, or customize assignments with different instructions for each individual or group receiving the assignment. • Allow lecturers to specify timelines and due date for assignment completion. • Allow lecturers to specify different options for returning assignments via email or system upload of file(s). • Allow students the option to recall their submission if they change their mind and want to make additional modifications. • Organise and store assignments in a central repository to allow lecturers to review assignments submission status, which assignments have been graded, and which has been published. • Allow lecturers to provide feedback on all assignments. • Automatically link each graded assignment into the grade book.

		• Allow the use of Adobe Acrobat and PDF files for assignment submissions as lecturers can overlay freehand comments in coloured text on the PDF document, while reserving the original submission as opposed to making use of the "Track Changes" and "Insert Comments" features in word documents when in-depth comments are to be made when marking electronic submissions.
Survey	A tool to administer a survey.	• The following survey tool properties should be included in a VLS (Botturi, 2004; Barron, 2003)**:** • Create, conduct and analyse surveys. • Permit anonymous responses to surveys.
F. Content authoring, delivery and management	**Definition**	**Description of learning content authoring, delivery and management properties**
Content authoring	Course authoring uses content creation tools for educational content (Paulsen, Nipper & Holmberg, 2003).	The following content authoring tool properties should be included in a VLS (Barron, 2003; Wan et al., 2005; Robbins, 2002; Botturi, 2004; Wcet, n.d.-a): • Integrate a WYSIWYG (What You See Is What You Get) tool with a rich text editing interface similar to a word processor to create content eliminating the need for HTML knowledge. • Allow lecturers to create and organize linear learning sequences by course, lesson, and topic. • Allow lecturers to organize and reuse learning objects, and content. • Allow lecturers to create syllabi, course description and lessons. • Create quizzes and tests.
Content sharing/reuse	Software compliance with the WAI WCAG 1.0 AAA guidelines (Wcet, n.d.-b).	The following content sharing tools properties should be included in a VLS (Wcet, n.d.-a): • Provide a central learning objects repository to allow lecturers to share content with other lecturers and students. • Allow a system-wide or organisational unit repository.
Course Templates	Course templates that help lecturers create the initial structure for an online course (Wcet, n.d.-b).	The following course design tool properties should be included in a VLS (Wan et al., 2005; Wcet, n.d.-a): • Templates and storyboarding capabilities that integrate the principles of instructional design. • Create courses using pre-existing templates. • Wizards that allow course designers to set up the course homepage, syllabus, organizer pages, content modules, discussion.

Content delivery	Tools for delivery of course content.	The following content delivery tool properties should be included in a VLS (Oliver, 2001; Wan et al., 2005; Elementk, 2003; Kalinga, 2008; Blackboard, n.d.-a.; Sachan, 2006): • Lecturers can save text documents in HTML format and upload these to VLS. • Store slide archives, oral histories or digital libraries to assist with student research. • Upload and view online course syllabi, topic outlines and learning. materials/ resources (such as activities, exercises, lessons, quizzes, examples, self-test). • Produce content in different media. • Enable instructors to upload and display an existing syllabus for the subject. • Import course cartridges containing additional readings, multimedia and question banks authored by major education publishers. • Enable a separate e-Reserves folders for digital copyright-cleared reserve readings created by libraries at the faculty's request. • Support glossaries. • Support different content types, namely audio, video, animation, HTML, JAVA, flash, PowerPoint, and Word. • Describe course content using metadata. • A central content repository where files can be saved; searched and retrieved by other lecturers. • Allow links to other training web sites or other resources. • "Export Content" link available on course content pages. • Lessons should have pages, questions, question types, answers and responses to answers. Further there should be a logical order or navigation order, grading and re-takes. • Instructors should be able to create a lesson, view a lesson, and add a question page to a lesson. • Supplement courses by integrating specific learning references into the platform and allowing access to external resources.
Content and File Management	Allows for content and files to be managed and shared by organising them into different folders (Blackboard, n.d.-a:11).	The following content and file management tool properties should be included in a VLS (Blackboard, n.d.-a; Sachan, 2006; Wcet, n.d.-a; Wan et al., 2005; Sierra et al., 2005; Kalinga, 2008; Botturi, 2004): • Allow lecturers to personalize access to specific course materials and assessments, based on access rights, group membership, previous course activity, or student performance and/or specific start and end dates or other criteria. • Enable version tracking and linking to specific versions as well as the creation and management of workflows for collaborative content creation and review.

		• Allow lecturers to selectively release materials, course content, assessments, announcements, and emails based on previous course activity or specific start and end dates. • Allow lecturers to designate whether their files are private or publicly accessible. • Alert on requesting /receiving of course content by student. • Allow users to automatically archive and track previous versions of their files. • Create separate copies after each contributor changes the document, thus providing an automatic backup for overwritten files. • Allow lecturers to add new resources to a specific course as well as to remove and modify them. • Offer easy-to-use conversion tools to convert from one file format to another for content migration purposes. • Search/browse learning objects based on metadata. • Present learning objects individually. • Maintain a centralized learning object repository. • Check out/check in/get files. • Allow lecturers and students to upload files. • Allow lecturers to create folders. • Allow lecturers to insert web links. • Allow lecturers to create different access portals. • Allow lecturers (and students) to download content for off-line use. • Specify the structure of the course in something that looks a bit like a conventional table of contents with different levels of content organization, modules and lessons instead of sections and chapters. • Searching for objects using a learning object catalogue.

2.3.3 Non-functional system characteristics

This section covers the non-functional system characteristics that need to be supported in a VLS. According to Wheeler (n.d.), the following non-functional system characteristics should be considered when adopting open-source software: maintenance, reliability, performance, scalability, usability, security, flexibility, customizability, and interoperability. According to Trice and Treacy (1988), information system characteristics affect the efficiency and effectiveness of the user's interaction with a computer system. Some of the characteristics considered for the purposes of this study were as follows:

a) Usability

A major criterion for lecturers and students alike is ease of use when they commence using new technology. Users will be more willing to use an environment that looks and feels familiar (Britain & Liber, 2004). According to McGill and Klobas (2009), ease of use leads to increased use. Usability is one of six general characteristics comprising the ISO 9126 standard measuring the quality of a software product (Bevan, 1999). This characteristic can be decomposed into the following sub-characteristics: “understandability, learnability, operability; attractiveness; usability compliance” (Abran, Khelifi, Suryn & Seffah, 2003:328). Usability is defined as “a set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users” (Zeist & Hendriks, 1996:275). Usability, as a quality factor, consists of three sub-factors, namely, understandability, which “describes the users’ effort for recognizing the logical concept of an application and the applicability of that logical concept”; learnability, which is the “users’ effort for learning the application” and operability, which is the “users’ effort for operation and operation control” (Behkamal, Kahani & Akbari, 2009:602). Wyles (2004b) used the usability sub-characteristics of user-friendliness, high quality documentation and online help as criteria when evaluating open-source virtual learning system software for selection purposes. Kalinga (2008) expressed the need for defaults and templates for everything including the course home page. One of the findings of a study conducted by Egert et al. (2009) was the need to improve the user interfaces of virtual learning systems. According to Ardito et al. (2005), the usability properties of VLSs should allow both teachers and learners to capably operate the system, and should be suitable for the planned learning activities.

b) Security

Security is listed as an attribute of the functionality characteristic of the ISO 9126 standard on software product quality (Bevan, 1999). Security is the ability to prevent unauthorized access, whether accidental or deliberate, to programs and data (Behkamal et al., 2009:602). The system must contain “robust security and encryption mechanisms to protect content and user data” and should have a set of user privileges with accompanying permission levels to manage and revise content (Robbins, 2002: 3). In addition, the system must ensure the security of assessments (Robbins, 2002). The attribute security was one of the criteria used for selection of an open-source virtual learning system for adoption (Wyles, 2004a). Kalinga (2008) confirmed the need for protecting information within an educational network by emphasising user-authentication security to prevent unauthorized access to information. Security features needed in an VLS are: unique IDs and passwords with secure distribution; secure socket layer (SSL) for encrypting data exchanged over the Internet; restricted access to information based on permission levels; and activity logs for review purposes (Elementk, 2003). Egert et al. (2009) identified the need for private messaging or user-to-user messaging as a privacy or security measure. Sachan (2006) included privacy/security attributes with the inclusion of user events, group events and course events. User events are for private consumption only; group events are viewable by members of the designated group(s), and course events are viewable by enrolled class members. Database backups and recovery is another way of proving security.

c) Reliability

Reliability is another of the six general characteristics of the ISO 9126 standard on software product quality. This characteristic can be decomposed into the following sub-characteristics: “maturity; fault tolerance; recoverability; and reliability compliance” (Abran et al., 2003:328). Reliability is “a set of attributes that bear on the capability of software to maintain its level of performance under stated conditions for a stated period of time” (Zeist & Hendriks, 1996:275). Reliability consists of three sub-factors, which are defined as follows: (1) maturity, which is “the frequency of software faults”; (2) fault tolerance, which is “the ability of software to deal with software faults or infringement of its specified interface”; and (3) recoverability, which is the “capability to recover data affected in case of a failure and is measured by the time and effort needed for it” (Behkamal et al., 2009:602). Kalinga (2008) tested for the attribute recoverability by evaluating how good the e-learning system was at recovering from user errors. According to Horton and Horton (2003), an e-learning system should be reliable in that it does not freeze the computer, crash the browser, or overwhelm the server, and it should have little or no disruption/ downtime.

d) Robustness

Robustness was one of the criteria/requirements identified by Wyles (2004b) for evaluating open-source virtual learning system software. Kalinga (2008) checked for the attribute of robustness by testing the e-learning system developed for tolerance of user error.

e) Customisability

Customisability feature requirements in a VLS were expressed as follows: a distinctive user interface for the e-learning system, for example, inclusion of a company logo; dynamic and customisable content; ability to change the look and feel of the system; ability to customise the environment by adding book marking facilities; ability to add fields for tracking additional student information, and incorporating them in exports or reports; ability to develop custom reports, generate output in a number of formats, and export data to many file types (Elementk, 2003). In a survey conducted by Egert et al. (2009), students expressed the need for customization systems that allowed them to configure their virtual learning systems.

f) Efficiency

Efficiency is another of the six general categories of characteristics of the 2002 suite of ISO 9126 (Parts 1 to 4), which focuses on software product quality. This category can be decomposed into the following sub-characteristics**:** time behaviour; resource utilisation; and efficiency compliance (Abran et al., 2003). Efficiency is "a set of attributes that bear on the relationship between the level of performance of the software and the amount of resources used, under stated conditions" (Zeist & Hendriks, 1996:275). The time behaviour sub-characteristic describes "processing times and throughput rates while resource behaviour describes the amount of resources used and the duration of use" (Behkamal et al., 2009:603). Kalinga (2008) describes the following efficiency attributes that should be incorporated into an interactive e-learning system: efficient response time performance; keyboard shortcuts; and importing registered students into the system in one operation; performing operations on multiple objects, for example, by selecting all of them and then specifying the changes once.

g) Flexibility/Adaptability

Wyles (2004b) expressed the need for the following flexibility/adaptability requirements in an e-learning system: ability to add in new resources and processes, and ability to adjust topic-related learning activities according to the needs of a learner or sub-group gleaned from interactions between learners and the system or lecturers. In addition, sub-groups should be recognisable within a VLS once the learning activity is underway. Another requirement was file handling capabilities, namely, the writing of documents within the system or outside and uploading, individual or collective document writing, and deciding which areas students can upload (write) to. The discussion tools should be essential to the learning and available directly from a topic area. Content should be able to be removed from and inserted into the course structure (Wyles, 2004b). The Blackboard system claimed the following flexibility features: support for different learning styles, programs tailored to individuals and selective release of content and learning activities; access via wireless or PDA to course-related information such as announcements, calendar items and grades (Blackboard, n.d.-a).

h) Interoperability

Interoperability can be described as the ability of a software application to interact with specific systems (Behkamal et al., 2009). Interoperability standards and modular, extendable system architectures can provide the required flexibility for fast-paced, evolving technologies (Wyles, 2004b). According to Blinco et al. (2004:7), interoperability is demonstrated by the following five SCORM capabilities: "reusability, affordability, durability, accessibility, and interoperability". e-learning systems should have the capability to import content from and supply content to digital libraries and other e-learning systems, thereby providing enriched and updated content (Kritikou & Demestichas, 2008). Horton and Horton (2003) expressed the need for the following interoperability drivers: reuse of learning content from whole courses to reusable lessons, pages, learning media elements. Wyles (2004a) recommended that e-learning systems should interact with student management systems. The e-learning platform should be able to import student personal and enrolment data, as well as export data stored in the platform to other third-party applications (Elementk, 2003). The VLS should be able to import curricula-related resources developed by educational practitioners and academic publishers (Meerts, 2003).

i) Extensibility

Extensibility was one of the criteria/requirements identified by Wyles (2004b) for evaluating open-source virtual learning system software for selection purposes. An e-learning system should be extensible in that it should be easy to incorporate new courses, resources and new functions/features as they become available (Elementk, 2003).

j) Standards

Compliance implies that the system conforms to "standards, conventions or regulations in laws and similar prescriptions" (Behkamal et al., 2009:602). The oldest standards organisation is the Aviation Industry CBT committee or AICC. The AICC has expanded its base to many other groups producing and using e-learning content. Other organisations actively proposing standards are the IEEE's Learning Technology Standards Committee and the IMS Global Consortium. The IMS LD is used for describing a learning unit (Imsglobal, n.d.). A member of the standards club is the Advanced Distributed Learning (ADL)(Adlnet, n.d.) group's sharable content object reference model (SCORM) project. Sharable Content Object Reference Model (SCORM) is a "set of technical specifications that enables sharable, durable, and reusable Web-based learning content" (Elementk, 2003). SCORM is used for packaging of content resources (Adlnet, n.d.).

According to Blinco et al. (2004), there is an increase in the acceptance and adoption of technical standards namely IMS and ADL specifications and IEEE standards, among stakeholders for teaching, learning, and training purposes. Compliance to SCORM 1.2, IMS standards was one of the criteria/requirements identified by Wyles (2004b) for evaluating open-source virtual learning system software for selection purposes. Wan, Zhao, Liu and Sun (2005:2) impressed the need for system conformance to industry standards, such as “AICC, SCORM, IMS, HTML and XML”, in order to function in many platforms.

The major problems related to lack of standards reported by Horton and Horton (2003) were as follows: the difficulty of course creators to merge different vendors’ content and tools; inability of administrators to migrate courses containing several files from one VLS to another; inability of disabled learners to take the courses they need; and inability of custom developed courses to communicate with other systems. One of the specific goals of standards is the reuse of content at all levels from entire courses, to lessons, to pages, and multi-media objects. The holy grail of standards is interoperability, among authoring tools, content, and management systems. Typical authoring tools are Dreamweaver, Tool book, Trainersoft or Authorware. In this world of interoperability, virtual learning systems permit course creators to build courses by combining individual learning objects created by a multitude of tools and by many manufacturers. According to Blinco et al. (2004:8), “reuse” (re-composition/assembly) is attained by using a “wide range of standards (such as IMS Content Packaging, SCORM, and IEEE LOM)” and tools.

The IMS Question and Test Interoperability specification defines general ways of creating tests that can be implemented in different systems. IMS QT1 is used for packaging of assessments. Virtual learning systems often need to exchange data with other corporate systems. The IMS Enterprise Information mode seeks to define formats for exchanging administrative data among such systems. The IMS Learner Information Packaging specification attempts to define a common format for information about learners. Descriptions adhering to specification could then freely be exchanged among systems (Imsglobal, n.d.). The IMS Content Packaging Specification describes how electronic resources can be structured into “logical learning units termed content packages” (Brooks & Kettel, 2005:2).

The issue of accessibility standards was raised by Neal and Miller (2005) and Chisholm, Vanderheiden and Jacobs (2001) who expressed the need for virtual learning systems and websites to be accessible to people with disabilities.

According to Blinco et al. (2004:8), “digital rights management” is a problematic development area, and much effort has been put into “focused requirements for digital rights expression languages” by e-learning constituencies.

The OpenID Connect 1.0 standard allows identity confirmation of the end-user based on the user authentication schemes conducted by an authorization server, in addition to acquiring end-user basic profile information (Sakimura, Bradley, Jones, De Medeiros & Jay, n.d.). This means that you only have to remember one username and one password to log into websites.

2.3.4 Non-functional system challenges

An e-learning system's user interface can be an obstacle if it is poorly designed where users become confused, lost or annoyed with ambiguous menus, buttons or links (Lanzilotti, Costabile & Ardito, 2006).

According to Mcgee and Green (2008:154), VLSs are being forced to change the architecture that contributed to the transformation of online courses in order to keep abreast of the movement towards "open, seamless, mobile, social, and transparent learning". Web 2.0 applications have the "sophistication of graphic user interface designs" that surpass the ostensibly "archaic interfaces" of VLSs (Mcgee & Green, 2008:154). Alexander (2008:199) observed that the look and feel of VLSs and web 2.0 platforms are dissimilar, with Blackboard's interface akin to "commercial training platforms, such as IBM's Learning Space", as opposed to the "fluid micro-content arrays" offered by Web 2.0 platforms such as MySpace. Wikis integrated into a VLS should incorporate an editing toolbar with a straightforward edit style, which is easier to use than having to know wiki syntax (Augar et al., 2006).

According to Mcgee and Green (2008), the user centeredness of web 2.0 applications is so persuasive, that it is difficult to foresee how administrator and instructor driven VLSs can afford to truly support effective and efficient learning designs that can compete with the appeal of these tools. In a study conducted by Egert et al. (2009), students compared social media systems to virtual learning systems and recommended the following improvements for VLS communication tools: user-to-user messaging, notification and awareness mechanisms, thread organization and management as well as better ways for managing group and individual messages.

2.4 VLS usage behaviour in higher education

According to Welle-Strand and Thune (2003), universities and higher learning institutions are viewed as the main driving force for advancement and competition. The VLSs used in higher education have reached an important stage in their evolution life cycle. With e-learning becoming integral to the curriculum in many colleges and universities, the scope and functionality underlying VLSs are growing to reflect the needs of a growing base of academic staff, administrators and students (Gallagher, 2003).

According to Morgan (2003), faculty members use virtual learning systems to increase communication with their students, give students access to course materials, provide grade book convenience and transparency, use more interactive materials in their teaching, increase the amount of feedback and promptness of feedback to students, get students to hold discussions and engage with course materials in a slower paced manner. Although 59% of the respondents in Morgan's study reported that the VLS increased their communication with students, the mode of communication "was broadcast in nature, from the faculty member to the student" (Brown & Peterson, 2008). Morgan (2003) reported that faculties were gaining, at least one key principle of good practice by increased feedback to students through the use of the online grade book (Brown & Peterson, 2008). Morgan (2003) acknowledged that, while there is evidence that the VLS increases interactions between faculty and students, faculty use the VLS mainly to administer quizzes and perform other administrative tasks rather than function as a pedagogical tool. A survey of VLS usage, at the University of Wisconsin, revealed that content tools received heavier use than the other tools (Morgan, 2003). Use was skewed in the form of content provision in the form of syllabi, course documents, staff information and announcements.

Hearsay evidence points to a trend in higher education where virtual learning systems are used for a "delivery" teaching style, as it facilitates easy distribution of lecture material and convenient submission of students' assignments (Beck, 2005).

According to Oliver (2001), a major concern of VLS faculty use is that distribution tools are emphasised over student interaction and engagement tools such as discussions, sharing of information, development of artefacts, creating knowledge, analysing cases etc. Faculties that rely on an integrated VLS may be unable to involve students' in community building, researching poorly-defined problems and knowledge construction learning activities. Alternative tools should be sought to support analysis, synthesis and evaluation type learning activities. Instruction strategies that require development of course-related material are supported by external tools such as web page editors, authoring software and video editing software. An instructional strategy that requires researching poorly-defined problems can be supported by the VisIT tool, which provides online searching, visual documenting, and concept mapping capabilities. An instructional strategy that requires the development of community documents and databases require collaborative tools such as online forms, web annotation software and concept mapping software.

According to Brown and Peterson (2008), students are developing incipient visual literacy in Flickr, communication skills in Facebook, team and organisational skills in Base camp, and they are developing new kinds of learning in virtual worlds and in games. Many progressive educators are now conducting authentic learning using Wikis, blogs, open source ePortfolios and Personal Learning Environments (PLEs).

The survey of instructors conducted by Brannon and Essex (2001) on the use of synchronous and asynchronous tools in distance education reported asynchronous communication to be more helpful for in-depth, more thoughtful discussion, allowing all students to respond to a topic.

According to Hurlburt (2008), blogs contained within VLSs offer very little in the way of personalization of the virtual learning space when compared to blog environments such as WordPress or Blogger. Hurlburt (2008) attributes this lack to VLS designs that are based on nineteenth and twentieth century pedagogical models that fail to recognize the potential in social constructivist models for learning.

A survey of instructors conducted by Brannon and Essex (2001) reported that community building was one of the reasons given for using the synchronous chat tool. Oliver and Moore (2008) reported that learning to use a system and preparation of course-related materials needed to take place prior to making interactive and collaborative uses of the educational tools.

In a study conducted by Martin (2008), on the usefulness of Blackboard features from the perspective of instructors and students, it was reported that assignments, grade book and course documents were the most useful. The availability of immediate feedback for online quizzes was reported to be the most helpful feature.

While virtual learning systems include various communication tools to enable staff-student interaction, they are mainly used as repositories for course related material (Kemp & Livingstone, 2006). One of the reported benefits of this mode of use was flexible, secure password-controlled access to course materials. More skilled lecturers, however, use a range of communication tools, namely, discussion forums and chat tools, as well as assessment tools such as assignment file drop-boxes, self-scoring quizzes and grade books. Educational content was typically stored in static documents, consisting of copies of PowerPoint slides and Word documents. Assessment and interactive features were used less often. Use of multi-media is less common and VLSs do not support the development of multi-media content (Kemp & Livingstone, 2006). It is evident that the full potential of these tools to support interactive learning is not being realised.

In a study conducted by Disbrow (2008), students most frequently cited convenience and increased interactivity as positive aspects of using the online audio conferencing tool in online communication courses. “Technological problems” was the most frequently cited drawback to the tool.

While VLSs have integrated capabilities to support learners and the learning process, it would appear that many lecturers use VLSs as a delivery method for the subject matter. There is an underutilization of functionalities to present the learning material using multimedia (Vovides et al., 2007).

2.5 Implications of VLSs for teaching and learning in higher education

Virtual learning systems (VLSs) are assuming an important role in the academic enterprise of teaching and learning that enterprise resource planning (ERP) systems occupy in the administrative arena. A VLS contains aspects of administration but also deals directly with the core aspects of teaching (it may contains learning objects, class exercises, quizzes and tests). It may have tools for real-time chats or asynchronous bulletin board communication. Just as an administrative ERP relates to various aspects of higher education such as finance, human resources, etc., the VLS is poised to make an impact on all aspects of teaching and learning and student-teacher interactions. The implication that VLSs are as critical to the teaching and learning enterprise as ERP are to campus administrative endeavour, means that the VLS must be available twenty four hours a day, seven days a week like e-mail and the web because faculty and students will be using the VLS at all times (Meerts, 2003).

According to Britain and Liber (2004), one major reason why the predominant pattern of use of VLSs is for the basic course management tasks and, consequently, why there has been little pedagogical innovation using these tools to date is that the first generation VLSs do not obviously support more radical or diverse learning activities. If the design of the software environment encourages a pattern of use that mimics traditional lecturer-student roles, there is little incentive for lecturers to adopt new approaches.

The VLS functions/features discussed in this chapter were used to identify the core set of generic system functions/features, which assisted in the development of the research instruments to answer two main research questions for this study. One of the research questions was to identify the system functions/features that were deemed useful by educators for integrating e-learning in South African residential institutions of higher education. Another research question dealt with the extent and frequency of feature usage, as well as total system usage, and usage clusters by educators in the two residential institutions, which served as the cases for the empirical part of the study. The discussion on e-learning practices in higher education was used to ascertain whether the perceived usefulness of functions/features contributed to actual system usage. The functions/features of the two VLSs namely Blackboard and Moodle used by educators at DUT and UKZN are described in Chapter 3. Since the generic functions/features set discussed in this chapter, and specific functions/features set of the two VLSs, namely, Blackboard and Moodle cannot be used in isolation to study VLS usage behaviour among educators, other categories were considered, namely, pedagogic aspects of the educational domain, organisational factors, user difference factors and demographic factors, which are discussed in Chapter 4.

2.6 Summary

Universities and technical institutes in a developing country like South Africa are faced with the challenge of adopting and embracing a virtual learning system to implement e-learning. This class of software allowed these higher education institutions to stay abreast of the latest educational technologies, to be competitive in the higher education domain and to afford their stakeholders new innovative ways of teaching and learning. This chapter defined and differentiated e-learning concepts and discussed the trends in e-learning. The trends in e-learning lent insight into how the current VLS functionality and design should be evolved in order to better serve pedagogical innovation in terms of support for diverse learning activities. In keeping with this goal, functions/features currently supported in a VLS as well as those that need to be integrated in a VLS were summarised and tabulated. This set of tool functions and associated properties would serve as a baseline for eliciting educator input on the functions/features deemed useful in a VLS, as perceived usefulness has been indicated in previous studies as a determinant of usage behaviour. The literature on non-functional system characteristics was also covered in this chapter with a view to understanding the importance attached to these characteristics and their potential influence on system usage. The literature on VLS usage in higher education was reviewed with a view to analyse the scope and extent of VLS usage for the two cases examined in this study, which is discussed in Chapters 6 and 7. Chapter 3 provides a description of the functions/features of the two VLSs, namely, Blackboard and Moodle falling within the scope of this study.

CHAPTER 3: BLACKBOARD AND MOODLE FUNCTIONS / FEATURES

3.1 Introduction

This chapter provides a description of the functions/features supported by the two virtual learning systems in this study, namely, Backboard and Moodle. These systems were selected because they were adopted as the official VLSs at the Durban University of Technology (DUT) and University of KwaZulu-Natal (UKZN), respectively, which represent the two cases falling within the scope of this study. Furthermore, Blackboard and Moodle are also the two VLSs that are widely used by higher educational institutions worldwide and, therefore, appropriate to use for this research. Each of the VLSs is discussed under the headings of communication; student productivity; student involvement; administration/management; assessment; and student tracking. In addition, a discussion on the non-functional characteristics supported by Blackboard and Moodle were organised as follows: customizability; usability; performance; security; extensibility; and standards.

3.2 A summary of Blackboard (cc enterprise and cc basic version) and Moodle (version 1.9x) functions/features

The Blackboard learning system is software that permits educational institutions to create and host entire online courses on the internet or to supplement traditional classroom courses using the Internet. The Blackboard learning system is a popular commercial VLS that is used by over 2000 institutions in 35 countries (Blackboard, n.d.-a).

Moodle is an open source virtual learning system that can be accessed by users through a web browser. According to Cole and Foster (2007), social constructivism is the core educational philosophy upon which Moodle was developed. Hence, Moodle tools are built into an interface where the learning task is central. Teachers are able to organize their Moodle course (s) by “week, topic, or social arrangement. Moodle focuses on tools for discussion and sharing ideas and engaging in the construction of knowledge” (Cole & Foster, 2007:5).

A summary of the functions/features supported by Blackboard and Moodle falling within the scope of this study is presented in Table 3.1.

Table 3.1: Functions/features of Blackboard and Moodle VLSs

A. Communication tool functions	Blackboard	Moodle
Discussion forums	Discussion forums provide the following capabilities for section designers and instructors, some of which can be performed by students (Blackboard Inc., 2006; Wcet, n.d.-a): • Create topics within a course or module to which enrolled students can post and reply to messages. • Pose questions. • Share ideas. • Grade student participation. • Create threaded discussion topics whereby participants post and reply to messages. • Create a class blog, which allows participants to post a series of entries on a particular topic, which is displayed in chronological order. • Create a journal topic to allow for students' own writing. • Create discussion categories. • Create and manage discussion topics. • Lock messages and threads so that students can only read messages, they are unable to reply, comment, edit, forward, or do peer reviews.	Discussion forums provide the following capabilities for teachers, some of which can be performed by students (Cole & Foster, 2007; Moodle, n.d.-a) • Post comments whereby students and teachers exchange ideas. • Create a single, simple discussion designed for short/time-limited discussion on a single subject or topic to keep students focussed on a particular issue. • Create Q and A forum, which requires students to post their perspectives before viewing and responding to other students' postings. • Create a standard forum for general use supporting one or more discussions, and anyone with permission can post multiple discussions. • Subscribe to Moodle forums, which automatically send all new posts to the email address stored in the user's profile. • Grade forum posts, which can be graded by the teacher or other students. • Search for a particular word within a forum post. • Create a teacher/tutor-only forum, which is a hidden forum" that can be viewed by teachers but cannot be accessed by students.
Discussion management	Discussion management capabilities offered to instructors or teachers are as follows (Wcet, n.d.-a): • Allow students to create discussion groups. • Set up moderated discussions where all posts are screened. • Allow posts to be peer reviewed by other students. • View statistical summaries of discussions displaying participation, which can be used to generate grades. • Share discussions across courses, departments, or any institutional unit.	Discussion management capabilities offered to instructors or teachers are as follows (Wcet, n.d.-a): • Allow students to create discussion groups. • Set up moderated discussions where all posts are screened. • Allow posts to be peer reviewed by other students. • View statistical summaries of discussions displaying participation, which can be used to generate grades. • Share discussions across courses, departments, or any institutional unit.

Electronic File exchange	Electronic File exchange capabilities are as follows (Wcet, n.d.-a): • Students can upload and download files into a private folder. • Students can upload files to a shared group folder. • Students can submit assignments using drop boxes. • Instructors can upload files to a student's private folder • Students can also submit assignments to instructors via an integrated assignment tool. • Students and instructors can also exchange content outside of course boundaries. • Students may access their folders and upload content using WebDAV • Instructors can comment, track, and create versions of documents.	Electronic File exchange capabilities are as follows (Cole & Foster, 2007:89; Wcet, n.d.-a): • Upload files or assignments created online and offline using the assignment tool. • Upload any type of electronic file. • Add files to a files area.
Internal mail	Internal mail capabilities allow users to: (Blackboard Inc., 2006:462; Wcet, n.d.-a) • Communicate by sending mail to other users in the course or section using the *Mail* tool. • Read and reply to messages. • Forward messages. • Create and send messages. • Create and save messages as drafts. • Edit draft messages. • Preview messages. • Sort messages. • Copy and move messages. • Print messages. • Delete messages.	Internal mail capabilities allow users to (Cole & Foster, 2007:89; Wcet, n.d.-a): • Send messages. • Read and reply to messages. • Search messages. • Manage contacts. • Obtain a record of messages sent to/from a person (message history). • Change message settings.
Online Journal/ Notes	Online Journal/ Notes capabilities are (Blackboard Inc., 2006:273): • A journal can be a topic type. • Journal topics can be private.	Online Journal/ Notes capabilities are (Cole & Foster, 2007:171 -172): • Blogs are a form of online journal that are used for self-expression and communicating. • Blogs in Moodle are user-based where each user has his own blog, which is non-course specific.

		Blog capabilities are: • View blog entries. • Create new blog entries. • Edit and manage entries. • Manage personal tags. • Manage official tags.
Real-time chat	Real-time chat capabilities allow course members to (Blackboard Inc., 2006): • Communicate in real time to selected members or all members of the course. • Section designers and instructors can send messages as well as URLS to all users in the chat room. • Create and enter rooms. • Edit chat properties. • Set release criteria for items. • Show or hide rooms. • View chat room logs only for section instructors. • Delete rooms for all user roles.	Real-time chat capabilities allow (Cole & Foster, 2007): • Teachers and students that are logged in at the same time to communicate in real time.
Whiteboard	Whiteboard capabilities are as follows (Blackboard Inc., 2006): • Enter text, draw objects and lines. • Import images. • Play slide shows. • Print and clear whiteboard content. • Move items on Whiteboard for designers. • Section designers and instructors can load files onto the Whiteboard, save whiteboard drawings as files or slides.	It can supported by adding available 3rd party modules for Dimdim, Elluminate or other products (Wcet, n.d.-a).
Announcements	Announcement capabilities allow section designers and instructors to (Blackboard Inc., 2006): • Create and send text messages to all members enrolled for a course. • Create, edit, preview, sort; and delete announcements.	Announcement or news forum capabilities allow teachers to (Cole & Foster, 2007; Moodle, n.d.-a): • Broadcast exam dates, times or changes to exams, lectures or seminars. • Provide important information about course work throughout a semester. • Post special messages about upcoming events and news.

Wikis	• No internal wiki capability. • Can link to external wikis, however passwords are required.	Wiki capabilities include (Cole & Foster, 2007): • Create a wiki. • Other pages can be added to a wiki. • Navigate to the editing view of the new wiki page. • Browse and edit a wiki. • View the pages that have links pointing to the page currently being viewed, and access the version history of the page.
Audio and Video Conferencing	Not supported.	Not supported.
Virtual worlds	Not supported.	Not supported.
B. Student productivity tool functions/features	**Blackboard**	**Moodle**
Bookmarks	Bookmark capabilities (Blackboard Inc., 2006:4; 8): • *Bookmarks* tool is used to "create links to pages within the learning module, the *Notes* tool to create private notes pertinent to content in the learning module".	Bookmark capabilities (Cole & Foster, 2007): • Browser menu allows users to set bookmarks.
Calendar/Progress Review	Calendar/Progress Review capabilities are (Wcet, n.d.-a): • Supports "personal home page that lists all courses in which a student is enrolled, new email and all course and system-wide events from their personal calendar".	Calendar/Progress Review capabilities are (Cole & Foster, 2007; Wcet, n.d.-a): • A *user calendar can* contain personal events that a user can create and are only viewable by the user. • "Students can view their grades on completed assignments, total points possible, course grades and compare their grade against class performance".
Searching and filtering within a course	Searching and filtering capabilities (Blackboard Inc., 2006:661): • The *Search* tool permits users to perform searches for data within a course. • The user can "choose to view a record, refine or expand the search using advanced search functionality, or conduct a new search".	Searching and filtering capabilities (Cole & Foster, 2007): Forums within a course are searchable as well as browseable.

Work Offline/ Synchronize	Work Offline/ Synchronize capability (Wcet, n.d.-a): • "Instructors can publish course content on a CD that can be linked to dynamically from within the online course or viewed offline".	Does not support this capability.
Orientation/Help	Orientation/Help capability (Wcet, n.d.-a) includes: • Online tutorials for students that help students learn how to use the system. • A student manual.	Orientation/help capability: • There is a question mark in a yellow circle, which is a context sensitive link to Moodle's help system.
PDP	Not supported.	Not supported.
C. Student Involvement tool functions/services	**Blackboard**	**Moodle**
Group work	Group work capabilities are as follows (Wcet, n.d.-a): • Supports lecturers in assigning students into groups. • Each group can have their own shared file exchange, private group discussion forum, synchronous tools and group email list.	Group work capabilities are as follows (Wcet, n.d.-a): • Instructors or teachers can assign students to groups. • Instructors or teachers can randomly create groups of a certain size or a set number of groups. • Students can self-select groups. • Each group can have its own chat. • Each group can be given group-specific assignments or activities. • Groups can be private or instructors can monitor groups.
Community networking	Community networking capabilities are as follows (Wcet, n.d.-a): • Creation of online clubs, interest and study groups on the system. • Students from different courses can interact in system-wide chat rooms or discussion forums.	Community networking capabilities are as follows " (Wcet, n.d.-a): • Creation of online chats, interest, and study groups at the system level. • Students from different courses can interact in system-wide chat rooms or discussion forums.

Student profiles	Student profile capability (Wcet, n.d.-a): • Allow students to create a personal home page where a photo, personal information, and links to important websites can be incorporated.	Student profile capability (Cole & Foster, 2007): • Students can include personal details including a photo or an image and contact information. • Student’s picture appears in forum postings, in profile, and on the participant’s page.
D. Course administration and management	**Blackboard**	**Moodle**
Authentication	Authentication features offered to administrators are as follows (Blackboard Inc., 2006:590; Wcet, n.d.-a): • Allow guest access to all courses. • Authenticate user names and passwords against an external Lightweight Directory Access Protocol (LDAP) server or Kerberos™ network authentication protocol authentication protocol. • Support for the Central Authentication Service (CAS). • Set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server) fails. • Support for many organizational units and virtual hosts within a server configuration. • Authenticate Blackboard Learning System users on the external application and redirecting them to the appropriate location in that application. • Use custom authentication to validate user names and passwords.	Authentication features offered to administrators are as follows (Wcet, n.d.-a): • Allow guest access to all courses. • Authenticate user names and passwords against an external Lightweight Directory Access Protocol (LDAP) server or Kerberos™ network authentication protocol authentication protocol. • Support for the Central Authentication Service (CAS). • System authentication against IMAP, POP3 or secure NNTP. • Set up fail-through authentication against a secondary source (e.g. the system's own database) in the event that the primary source (e.g. LDAP server- Lightweight Directory Access Protocol) fails. • Support for many organisational units and virtual hosts within a server configuration.
Course authorization	Course authorization features for administrators are as follows (Wcet, n.d.-a): • Restrict access based on roles and roles can also be customized by the service provider. • Create an unlimited number of custom organisational units and roles with specific access privileges to course content and tools. • Distribute the permissions and roles across multiple institutions/departments hosted in the server environment.	Course authorization features for administrators are as follows (Wcet, n.d.-a): • Restrict access based on roles and roles can also be customized by the service provider. • Create an unlimited number of custom organisational units and roles with specific access privileges to course content and tools. • Distribute the permissions and roles across multiple institutions/departments hosted in the server environment.

	• Assign different roles to instructors or students in different courses.	• Assign different roles to instructors or students in different courses.
Registration integration	Registration integration features for administrators and instructors are as follows (Wcet, n.d.-a): • Instructors can add students to their courses manually or allow students to self-register. • Administrators can batch add students to the system using a delimited text file. • Administrators can transfer student information bi-directionally between the system and student information system (SIS) using delimited text files. • Support data interchange with student information systems through an event-driven application program interface (API). • The software supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. • Compliant with the IMS Enterprise Specification for Student Data.	Registration integration features for administrators and instructors are as follows (Cole & Foster, 2007:50; Wcet, n.d.-a): • Students can either sign up themselves or be automatically added by the university's enrolment system. • Teachers can manually enrol a teaching assistant, an outside guest, or a student with financial problems i.e., assigned a role in the Moodle course. • Administrator assigns the role of teacher. • Administrators can batch add students to the system using a delimited text file. • Administrators can transfer student information bi-directionally between the system and an SIS using delimited text files. • Administrators can transfer student information bi-directionally between the system and an SIS using IMS Enterprise Specification v1.1 XML files via web services. • The software supports data interchange with student information systems through an event-driven API. • The software supports integration with SCT Banner, SCT Luminis, Datatel, PeopleSoft 8 or customized integration with other SIS or portal systems. • The software is compliant with the IMS Enterprise Specification for Student Data.
Course management	The following VLS functions are supported for section designers and instructors (Blackboard Inc., 2006; Wcet, n.d.-a) • Use built-in tools to perform required activities e.g. assessments tools to create and edit quizzes, discussion tools to create discussion topics. • Select or use predefined text and background colours. • Selectively release or control the release of content and specific items (i.e. assignments, assessments, and announcements) based on in a course.	The following virtual learning system functions are supported for teachers (Cole & Foster, 2007:5; Wcet, n.d.-a) • Select a format and settings for a course, enable editing; label and summarize each topic or weekly section in a course. • Add activities to a course e.g. add activities such as forums, quizzes, lessons, and assignments. • Show or hide an item; remove an item or block; move an item to another section; move blocks to the left- or right-

	• Release materials based on single criteria (date, grade, etc.). • Use Boolean expressions to identify multiple selective release criteria. • Set up specific course content that is released on a specific date and must be completed by students before they continue with the course. • Link discussions to specific dates or course events. • Provide access to specific course materials based on group membership or performance or previous course activity. • Temporarily hide/show items (tools, documents etc.). • Organise and present content using the course content tool. • Edit settings for tools in a course. • Import a variety of content into a course from third-party applications and other Blackboard learning system courses. • Reset a course for a new semester/year. • Provide information about a course by setting up a course preview page that is viewable by all users. • Set the dates forward for all course items by using the date rollover feature. • Produce student tracking reports, which generates statistics for all students in the course. • Create custom groups, multiple groups or groups with sign-up sheets, create discussion topics for groups. • Create chat or whiteboard rooms for groups. • Send mail messages to groups. • Edit group settings and sign-up sheet settings. • Delete groups.	hand columns; moves items up or down in their respective columns. • Selectively release assignments, assessments, and announcements based on specific start and stop dates. • Provide access to specific course materials based on group membership. • Add user roles i.e. add a teaching assistant, an outside guest, or a student who is having a problem with financial aid. • Create archives of courses using a backup tool. Backups can also be used to copy course resources and activities from one course to another" (Cole & Foster, 2007:61). • Restore and copy courses. • Manage users' viz. assign roles in courses, remove students from a course, override roles, and assign roles in activities. • Collect student feedback via survey and choice tools. • Define groups at the course level or activity level. • Obtain detailed logs, students' participation reports and detailed summary reports from the statistics menu.
E. Assessment/ evaluation/ progress tracking and reporting	**Blackboard**	**Moodle**
Course Assessments	The following course assessment tools/features are supported for section designers (Blackboard Inc., 2006): • Create, preview, and manage assessments; add questions to assessments; manage questions and parts; manage assessment properties.	The following course assessment tools/features are supported for teachers (Cole & Foster, 2007: 112 -113; Moodle, n.d.-b) • Create quizzes with a variety of question types and/or randomly generate quizzes from pools of questions. • Add created questions to the quiz.

	• Create quizzes, which are online tests submitted for marks and recorded in the grade book. • Create self-tests that are online tests completed by students and submitted for marks but not recorded in the grade book. • Save assessment questions to a question database. • Link Assessments to *Course Content* and learning modules. • Manage assessment questions organized in different sections or parts by creating, renaming, moving, ordering and deleting parts. • Manage assessment properties by "editing quiz properties, survey properties, and self-test properties" (Blackboard Inc., 2006:107- 120). • Export and import assessments (quizzes, surveys, and self-tests) (Blackboard Inc., 2006:123-125) to and from other Blackboard learning system courses, installations and other software.	• Allow students to re-take quizzes multiple times. • Get the system to score quizzes. • Use categories to organize quiz questions for a course, which serve as containers for sharing questions between courses. • Import test bank questions from a text file. • Sort questions "by type and name or by age; choose to display the question text below each question name"; change the order of the questions; allocate the marks for each question; set the "maximum grade" for the whole quiz; preview the quiz. • View quiz information; attempt quizzes; preview quizzes; grade quizzes manually; view quiz report; delete quiz attempts; ignore time limit on quizzes.
Automated Testing Management	The following automated testing management tools/features are supported for section designers (Blackboard Inc., 2006:103; 632; 642-643): • Create and "add images to questions". • Edit questions and question sets. • Assign points to questions. • Assign points to question sets. • Preview questions. • Modify selective release for questions. • Order questions. • Remove questions from an assessment" before students take the assessment. • Organize questions by grouping them into categories. • Create, browse, rename and delete categories. • Create a repository of questions for assessments in the question database.	The following automated testing management tools/features are supported for teachers (Cole & Foster, 2007:116): • Get an overview of the list of completed quiz attempts. • Re-grade or recalculate quiz grades if the possible number of points for the quiz or a question has been changed. • Manually grade essay questions. • Provide feedback by of written comments. • Perform "Item analysis," which evaluates the reliability of questions.
Online Marking Tools	The following online marking tools tools/features are supported for section designers (Blackboard Inc., 2006): • Create and edit grading forms by specifying evaluation criteria and performance indicators and numeric values	The following online marking tools/features are supported for section designers (Cole & Foster, 2007:198): • Use default scale "separate and connected ways of knowing" with three options: "mostly separate knowing;

	assigned to the performance indicators. • Preview grading forms by accessing a read-only view of the grading form; View content such as assignments, discussion topics, etc., that use the grading form. • Delete grading forms.	separate and connected; mostly connected knowing". • Create a scale using a rating system of choice by giving it a name, description and the scale, ranging from negative to positive, separated by commas. • Use newly created scale in any activity where a grade is given, except quizzes.
Online Grade book	The following online grade book tools/features are supported for section designers (Blackboard Inc., 2006:327): • View, enter, and manage grades for all students. • Enter descriptive data about students. • Grant or deny access to the course for all members.	The following online grade book tools/features are supported for teachers (Cole & Foster, 2007:193; Moodle, n.d.-c): • Tracking student scores in a course. • Use grade category, the grade item, and the grade, which represent student scores in a course.
Assignment-specific digital drop boxes	The following assignment-specific digital drop box tools/features are supported for section designers (Blackboard Inc., 2006): • Create and edit text and website type of assignments. • Edit group instructions. • Remove groups from an assignment. • Send assignments. • Manage assignments.	The following assignment-specific digital drop box tools/features are supported for teachers and students (Cole & Foster, 2007:123; Moodle, n.d.-c; Christensen, 2007): • View assignments. • Submit assignments. • Grade assignments. • Upload digital content such as "essays, spreadsheets, presentations, web pages, photographs, or small audio or video clips for grading". • Peer-assess assignments where students are given two grades: their own work and their peer assessments of other students' work. • Use a grading strategy for peer assessment of assignments with five options, namely, "No grading; Accumulative grading; Error Banded grading; Criterion grading; Rubrics".
Survey	The following survey tools/features are supported for section designers and students (Blackboard Inc., 2006): • Students complete and submit surveys anonymously, which are online questionnaires that are not awarded marks. • Create and edit surveys. • Manage surveys.	The following survey tools/features are supported for teachers and students (Cole & Foster, 2003:203): • Create surveys. • Administer surveys. • Store students' responses to surveys. • View responses. • Download responses.

F. Student Tracking	Blackboard	Moodle
Student Tracking	The following student tracking tools/features are supported for section designers (Wcet, n.d.-a; Blackboard Inc., 2006:691): • Track the frequency and duration of student access to individual course components. • Get reports showing the time and date and frequency students as an aggregated group accessed course content. • Get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. • Get *Summary of Activity* report providing an overall summary of user activity in the course. • Get *Tool Usage*, which gives an overview of how often each tool in the course is used. • Get *Course Item Usage*, which gives an overview of how often individual items in the course are used. • Get *Entry Page or Tool*, which gives an overview of the pages or tools most frequently used as course entry points. • Get *Exit Page or Tool*, which gives an overview of the pages or tools most frequently used as course exit points. • Get *File Usage, which* provides an overview of the content files that are viewed most frequently. • Get *Student Tracking reports*, which provide a detailed summary of activity information for individual Students in the course.	The following student tracking tools/features are supported for teachers (Wcet, n.d.-a; Cole & Foster, 2003:64-66): • Track the frequency and duration of student access to individual course components. • Obtain reports showing the time and date and frequency students as an aggregated group accessed course content. • Obtain reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. • Review the navigation record of each student. • Get aggregated usage statistics across courses or across the institution. Get "Live logs from the past hour", which lists all course activity in the past hour. • Get *Activity report*, which lists how many times each course activity has been viewed and the last time it was viewed.
G. Content authoring, delivery and management	**Blackboard**	**Moodle**
Content authoring	The following content authoring tools/features are supported for section designers (Blackboard Inc., 2006:217; 255): ▪ Create text or HTML files, or select files from *File Manager*. • Create folders to further organize content within the *Course Content* tool.	The following content authoring tools/features are supported for teachers (Cole & Foster, 2003:29): • Add content to a course using the "add a resource" drop-down menu. • Add resources to a course permit adding content such as

	• Create, edit, show or hide files; move folders to a different content folder; move links and delete content folders. • Add links to content in other course tools, for example, add content links to “assignments in the *Assignments* Tool”, and to “quizzes in the *Assessments* Tool” from the *Course Content* tool. • Edit content items directly from the *Course Content* tool if content links were added to items. • Preview content links as they would appear to students; Show or hide content links; customize links; move links to a content folder; remove links to files or content items; view links to an item or file. • Add files; browse for files; create files; edit files; preview files; show or hide files. • Organise “auxiliary course content, such as media files or glossary definitions” in the *Media Library* tool. • Link entries “in a *Media Library* collection to words in HTML files”.	web pages and links to web sites. • Insert a label creates a label directly on the course page. • “Compose a text page” and “Compose a web page,” can be used to develop content directly in Moodle. • “Link to a file or web site” and “Display a directory,” are used to manage content developed in other programs, such as Word or PowerPoint. • Add content from other web sites offering rich information resources available on the web. • “Add an IMS Content Package” enables the teacher to “add pre-packaged content from sites around the Web”. • Add media content to a course. • Display content of a course in more than one language.
Content sharing/reuse	The following content sharing/reuse tools/features are supported for section designers and instructors (Wcet, n.d.-a): • Share content with other instructors and students through a central learning objects repository, which can be system-wide or for individual organisational units. • Enable version tracking and linking to specific versions. • Create and manage workflows for collaborative content.	The following content sharing/reuse tools/features are supported for teachers (Wcet, n.d.-a): • Share content with other instructors and students.
Course Templates	The following course templates tools/features are supported for section designers and instructors (Wcet, n.d.-a): • Supports template-based course creation. • Provides course design wizards that provide step-by-step guides that take faculty and course designers through the completion of common course tasks, such as setting up the course homepage, syllabus, organizer pages, content modules, discussion. • Upload course content through WebDAV. • Use an existing course or a pre-defined template as a basis for a new course.	The following course templates tools/features are supported for teachers (Wcet, n.d.-a): • Supports template-based course creation. • Upload course content through WebDAV. • Use an existing course or a pre-defined template as a basis for a new course.

Content and File Management	The following content and file management tools/features are supported for section designers and instructors (Blackboard Inc., 2006:294): • Access *My Files* where the user's personal files is stored using *Content Manager*. • Use *File Manager* to create and store files used in a course. Use these files for course design activities. • Locating and viewing files and folders. • Creating and editing files and folders. • Managing files and folders by copying, moving, downloading, zipping, and deleting them. • Creating WebDAV Folders. • Use WebDAV (World Wide Web Distributed Authoring and Versioning) folders to access and manage *File Manager* files and folders from user's computer without logging in to the Blackboard Learning System. Any changes made in WebDAV folders are reflected in *File Manager* folders.	The following content and file management tools/features are supported for teachers (Cole & Foster, 2007:139-140; 151): • Upload and store files in the files area. • Create a link for students to access it. • "Move files to another folder; delete completely, which removes all trace of the file from your Moodle site; and create ZIP archive. • Save documents created in Word as Rich Text Format, or RTF. • Keep track of the server version and the latest version on the user's computer by using date versioning. • Add open content to a course by using the creative commons license to license work for use. • Create glossaries of terms and embed them in the course. • Edit the main glossary. • Allow student entries and comments in the secondary glossaries. • Create new glossary entries, manage entries, manage categories, create comments, manage comments, import entries, export entries, approve unapproved entries, rate entries, and view ratings. • Edit a lesson activity" and "manage a lesson activity".

3.3 A summary of Blackboard (cc enterprise and cc basic version) and Moodle (version 1.9x) non-functional characteristics

Table 3.2 provides a summary of the non-functional characteristics of Blackboard and Moodle falling within the scope of this study.

Table 3.2: Non-functional characteristics of Blackboard and Moodle VLSs

Non-functional Characteristics	Blackboard	Moodle
A. Usability	Usability testing focuses on quality by measuring if designs are reliable, useful, delightful, engaging and simple (Blackboard, n.d.-a): • The system provides default course look and feel templates. • The system includes online tutorials for students that help students learn how to use the system (Wcet, n.d.-a; Blackboard, n.d.-b)	• Access to "Moodle Docs" for page links at the bottom of each page to context-specific documentation (Cole & Foster, 2007). • The system provides default course look and feel templates.
B. Security	• Blackboard incorporates security properties for assessments and the browser used may require user acceptance of the Java security certificate when the *My Blackboard* screen first appears (Blackboard Inc., 2006).	• Moodle's has an anti-virus feature, the open source virus scanner ClamAV, which is recommended for installation on the server (Moodle, n.d.-c). • The HTTP security page contains just one option: *Use HTTPS for logins*, which encrypts the user's login data, making it difficult to sniff out a user's username and password on the network (Cole & Foster, 2007).
C. Customizability	Section designers, instructors and institutions can (Blackboard Inc., 2006; Wcet, n.d.-a): • Customize a course by selecting text and background colours and different icon styles or using own icons. • Change the order and name of menu items for a course. • Create an institutional look and feel template across the entire system, including institutional logos, headers, and footers. • Apply own look and feel template as well as institutional images, headers and footers. • Manage and customise the distribution and presentation of information.	Teachers can (Cole & Foster, 2007:242; Wcet, n.d.-a): • Select their preferred theme (colours, fonts, and icons) for a Moodle site on their "Edit profile" page. All Moodle pages will be displayed in the user's theme, apart from courses where a course theme has been set (Cole & Foster, 2007:242). • Change the order and name of menu items for a course. • Create their own look and feel templates across the entire system, including their own institutional logos, headers, and footers. • Apply individual look and feel templates as well as institutional images, headers and footers.

D. Efficiency/Performance	Testing to ensure that Blackboard Learn is more responsive and capable of handling greater volumes of user traffic with each release (Blackboard, n.d.-c).	• Moodle can be made to perform very well, at small usage levels or scaling up to many thousands of users.
E. Extensibility	• Blackboard provides a flexible, extensible and open architecture (Blackboard, n.d.-a). • Scalability and integration with student information system was cited as characteristics of Blackboard (Blackboard, n.d.-a).	• Download and install third-party modules and plug-ins from the *Moodle.org* modules and plug-ins database (Moodle, n.d.-d). • A plagiarism prevention tool such as Turnitin can be added as a plug-in module.
F. Standards	• Blackboard complies with the Sharable Content Object Reference Model (SCORM) standard and interoperability standards (Blackboard Inc., 2006).	• Support UTF-8, a standard for the display of non-Latin character sets, like Chinese or Arabic characters. • Select language settings for the front page and for each course visited (Cole & Foster, 2007). • Supports "SCORM (Sharable Content Object Reference Model), which is a collection of specifications that enable interoperability, accessibility and reusability of web-based learning content. (Moodle, n.d.-e).

3.4 Implications of VLS functions/features and non-functional characteristics for usage in higher education

The literature on the functions/features and non-functional characteristics of Blackboard and Moodle was used together with the generic VLS functions/features set in Chapter 2, to provide a framework and context for empirically analysing the:

- Perceived usefulness of these functions/features.
- Correlation between perceived usefulness of functions/features and actual system usage.
- Perceived importance attached to non-functional characteristics.
- Correlation between perceived importance of non-functional characteristics and actual system usage.
- Extent and frequency of usage and usage clusters.
- Gaps in functions/features.
- Challenges experienced by users (educators) relating to the respective VLS.

3.5 Summary

This chapter provided a description of the functions/features that fell within the scope of the study for the two VLSs, namely, Blackboard and Moodle. The following functions/features were described for each of the VLS: communication; student productivity; student involvement; administration/management; assessment; and student tracking. In addition, a brief overview of the non-functional system characteristics supported by each VLS was provided.

Chapter 4 undertakes a comprehensive literature review of the theories/ models, pedagogic, organisational and user difference factors that could potentially influence VLS usage.

CHAPTER 4: FACTORS THAT INFLUENCE VLS UTILISATION IN HIGHER EDUCATION

4.1 Introduction

The main research question to be addressed by this thesis is ‘What are the factors that influence virtual learning system usage in South African residential institutions of higher education?’ A literature review of the system factors comprising the generic set of online tutoring and didactic functions/features, and non-functional characteristics to be integrated in a VLS for online teaching and learning, as well as VLS usage patterns in higher education was undertaken in Chapter 2. Chapter 3 described the functions/features and the non-functional characteristics of the two virtual learning systems Backboard and Moodle, falling within the scope of this investigation.

The functions/features specification of the VLSs Blackboard and Moodle, provided specific instances of the generic VLS functions/features set presented in Chapter 2, Table 2.1. The combination of the generic VLS functions/features set, and the functions/features specifications of VLSs Blackboard and Moodle provided the framework and context for discussion of empirical findings of this study with regards to system functions/features, non-functional characteristics and challenges presented in Chapters 6 and 7. This chapter provides an overview of relevant theories, and focuses on the non-technical factors, which could influence VLS utilisation in higher education. Section 4.2 deals with theories relevant to technology utilization. Section 4.3 deals with pedagogic, organisational, user difference and demographic factors that could potentially influence virtual learning system usage. Section 4.3.1 covers the category of pedagogic factors (which are socio-technical in nature) such as characteristics of online teaching, pedagogical features, and pedagogic challenges. Section 4.3.2 deals with the category of organisational factors, namely, the university’s capability to support e-learning and organisational challenges. Section 4.3.3 deals with the category of user difference factors that could influence VLS utilisation. Section 4.4 discusses the implications of theories and non-technical factors on VLS utilisation in higher education. Section 4.5 covers the initial theoretical framework used for the study. Section 4.6 provides a summary of the chapter.

4.2 An overview of theories/ models applied to e-learning

The purpose of this section is to provide an overview of theories or models applied to the field of e-learning. This section on theories would contribute to the body of knowledge by testing the assumptions of underlying theories, replicating theories, synthesising theories and extending existing acceptance and usage models.

One of the most popular models used to understand university students' and teachers' intention to adopt e-learning was the (TAM/TAM2) and adaptations thereof (Abdel-Wahab, 2008; Venter, Van Rensburg & Davis, 2012). Other models applied to study the acceptance of e-learning is a combination of theory of reasoned action (TRA) and TAM (Asiri, Mahmud, Abu Bakar, Mohd Ayub & Fauzi, 2012), theory of planned behaviour (TPB) (Ajzen, 1991) and UTAUT (Venkatesh, Morris, Davis & Davis, 2004). The concept of facilitating conditions in UTAUT is relevant to organisational factors, which is presented in Section 4.3.2. The innovation diffusion model (IDM) was also applied to the field of educational innovations (Rogers, 1995). The task-technology fit model was used to study the relationship between VLS use and teacher performance (McGill, Klobas & Renzi, 2008). The updated DeLone and McLean information systems success model was adapted for examining the success of online learning systems (OLS) usage, the evaluation of WebCT and for measuring e-learning success (Hassanzadeh, Kanaani & Elahi, 2012; Lin, 2007). The adoption and use of technology conceptualised as a form of organisational change, and technology usage from an organisation perspective was highlighted in the literature (Myers & Avison, 2002).

The literature on user acceptance of information technology identifies several competing models or frameworks each accompanied by a different set of factors influencing information technology adoption. The most common acceptance models are TRA, TAM/TAM2, UTAUT, innovation diffusion model; and task-technology fit. The literature on utilisation of information systems identified the research framework of Mason-Mitroff (1973), as discussed in Trice and Treacy (1988:13), that spawned a stream of empirical research investigating the relationship between individual utilisation of an information system and four types of independent categorical variables, namely, "design and implementation process variables, information system characteristics, individual differences, and task characteristics". Markus, cited in Myers and Avison (2002), proposed a set of alternative theories, namely, system-determined, interaction and people-determined to explain the causes of resistance to the introduction of management information systems (MIS) in organisations. Nanayakkara (2007) proposed a model of factors relating to e-learning adoption that was centred on three key factors: individual, system and organisational. Each key factor was further broken down into sub-factor groupings. The factors identified under the user difference factor were "individual characteristics and individual perception" (Nanayakkara, 2007:6). The factors identified under the system factor were VLS "characteristics and external system characteristics" (Nanayakkara, 2007:7). The factors for the organisational factor were "organisational support and organisational characteristics" (Nanayakkara, 2007:7).

4.2.1 The Lewin-Schein model of change management, Fishbein theory of reasoned action and ergonomic theories of man-machine interaction

Utilisation can be modelled as a result, influenced by design and implementation processes, information system characteristics, tasks, users and their interaction (Trice & Treacy, 1988). The Mason-Mitroff (1973) research framework, as discussed in Trice and Treacy (1988), examined the association between an individual's utilisation of a computer system and four independent variable types: design and implementation processes, system features, individual characteristics, and characteristics of the tasks. Variables referring to design and implementation processes include training programmes, overall implementation strategy, top management support, user involvement, and understanding the tasks performed by users (Trice & Treacy, 1988). System features such as response time, stability, security, user interface and others can affect the interaction between a user and a computer system (Trice & Treacy, 1988). An individual's characteristics, for example, age, experience, educational level, cognitive styles, etc., influence beliefs, which ultimately have an effect on attitudes, intentions and information system use (Trice & Treacy, 1988). The characteristics of tasks refer to the type of the tasks users must perform. The assumption made is that more system use is better, as it is indicative of users' beliefs that the system is valuable.

The three underlying theories of utilisation research are the Lewin-Schein model of change management (implementation variables) (Schein,1996), Fishbein theory of reasoned action (individual characteristic variables) and ergonomic theories of man-machine interaction (individual characteristic and system variables) (Trice & Treacy, 1988). Lewin's basic change model characterises implementation as a process with three stages. Stage one involves unfreezing the environment of the organisation, thereby creating a climate for change in the environment (for example, an IS implementation). Stage two implements the change and stage three involves instituting the change so that it becomes an integral part of the organisation (Trice & Treacy, 1988; Schein, 1996).

4.2.2 Innovation diffusion model

The innovation diffusion theory proposed by Rogers (1995) hypothesizes that adoption behaviour is influenced by beliefs related to relative advantage, compatibility, complexity, trialability, and observability. The concept "relative advantage" is described as "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 1995:265). The concept "compatibility" is described as the "degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1995:266). The concept "complexity" is described as the "degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 1995:266). The concept “trailability is described as the “degree to which an innovation may be experimented with on a limited basis” (Rogers, 1995:266). The concept “observability” is described as the “degree to which the results of an innovation are visible to others” (Rogers, 1995:266). Empirical research shows that the concepts of “compatibility”, “complexity” (similar to perceived ease of use) and “relative advantage” (similar to perceived usefulness) are consistently related to adoption and utilization (Karahanna, 2006:782; IStheory, n.d.). Karahanna (2006:788) extended TAM to include the four compatibility beliefs that are hypothesised to influence actual use behaviours both directly and indirectly by ‘usefulness’ and ‘ease of use’ beliefs. Two of the four compatibility beliefs, namely, “compatibility with prior experience” and “compatibility with existing work practices” are likely to show positive effects on ease of use beliefs. Karahanna (2006:788) suggested that all four compatibility beliefs, namely, “compatibility with values”, “compatibility with prior experience”, “compatibility with existing work practices”, and “compatibility with one’s preferred work style” are likely to influence perceived usefulness. Perceived usefulness of an innovation refers to the fit between the innovation, one’s existing practices, and one’s preferred work style (Karahanna, 2006). According to Rogers (1995), individuals show dissimilar levels of willingness to adopt innovations, and made the observation that the segment of the population adopting an innovation is more or less normally distributed over time (Rogers, 1995).

4.2.3 Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), and Unified Theory of Acceptance and Use of Technology (UTAUT)

According to Davis (1989), the theory of reasoned action (TRA) has its origins in social psychology and is a well-known theory of human behaviour. TRA suggests that “a person’s performance of a specified behaviour is determined by his or her behavioural intention (BI) to perform the behaviour and BI is jointly determined by the person’s attitude (A) and subjective norm (SN)” (Davis, 1989:983). BI refers to a gauge of the strength of an individual’s intent to perform a specified behaviour. Attitude is defined as a person’s positive or negative feelings about executing the requisite behaviour. Subjective norm refers to “the person’s perception that most people who are important to him think he should or should not perform the behaviour in question” (Davis, 1989:984). A useful aspect of TRA from a IS perspective is its claim that other factors can only indirectly influence behaviour by virtue of the influence it brings to bear on attitude, subjective norm or their relative weights. Hence, variables such as “system design, user characteristics, task characteristics, nature of the development or implementation process, political influences, organisational structure”, etc., fit into the ‘other factors’ category (Davis, 1989:984).

An extension of TRA was the theory of planned behaviour (TPB), which included the concept of perceived behaviour control. In the theory of planned behaviour, “perceived behavioural control is theorized to be an additional determinant of intention and behaviour” (Venkatesh et al., 2004:429).

Perceived behavioural control is defined as the "the perceived ease or difficulty of performing the behaviour" (Venkatesh et al., 2004: 429).

Technology acceptance model (TAM) is an adaptation of TRA that is specifically adapted for modelling user acceptance of information systems (Davis, 1989). TAM suggests that two particular beliefs, namely, 'perceived usefulness' and 'perceived ease of use' are of particular importance for computer acceptance behaviours. Perceived usefulness (PU) is defined as the "potential user's subjective probability that using a specific application will enhance his or her job performance within an organisational context" (Davis, 1989:985). Perceived ease of use (EOU) refers to the "degree to which the future user expects the target system to be free of effort" (Davis, 1989:985). Similar to TRA, TAM assumes that behavioural intention (BI) is a determinant of system usage but differs from TRA in that an individual's 'attitude toward using the system (A)' and 'perceived usefulness (PU)' are viewed as the two joint determinants of BI. External variables and perceived ease of use (PEOU) are theorised to be determinants of perceived usefulness as contributors to improved work performance. External variables are also theorised to be determinants of perceived ease of use. Several studies have reported a significant correlation between system characteristics and perceived usefulness measures. Other external factors which may influence EOU include training, documentation and user support (Davis, 1989).

TAM2 used TAM as a base and incorporated "additional theoretical constructs covering social influence processes (i.e., subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use" (Venkatesh & Davis, 2000:187). TAM2 extends TAM by demonstrating that subjective norm has a significant direct effect on usage intentions in addition to perceived usefulness and perceived ease of use for a mandatory but not voluntary usage context. Subjective norm was found to significantly influence perceived usefulness via internalization, where social influences are integrated into people's usefulness perceptions, as well as identification, where people gain status and influence within the work group by using a system and, in so doing, improve their job performance. In addition to social influence processes, Venkatesh and Davis (2000:187) hypothesised the following four cognitive instrumental processes, namely, "job relevance, output quality, result demonstrability, and perceived ease of use" were determinants of perceived usefulness. Venkatesh and Davis (2000) believe that people make judgments of perceived usefulness by cognitively matching a system's capabilities with their job goals and tasks.

A unified model called the unified theory of acceptance and use of technology **(**UTAUT) was devised, with four key concepts, namely, "performance expectancy, effort expectancy, social influence, and facilitating conditions" and four moderators of key relationships (Venkatesh et al., 2004:447). The four key concepts were hypothesised to be determinants of acceptance and usage. "Gender, age, experience, and voluntariness of use" were identified as the key moderators mediating the influence of the four key concepts on intention and usage (Venkatesh et al., 2004:447). Performance expectancy is described as the "degree to which an individual believes that using the system will help to achieve gains in job performance" (Venkatesh et al., 2004:447). The perceived usefulness concept from TAM/TAM2 pertains to the determinant performance expectancy as do relative advantage from the innovation diffusion theory. The concept of effort expectancy is described as the "degree of ease associated with the use of the system" (Venkatesh et al., 2004:450). The two concepts from existing models, namely, perceived ease of use (TAM/TAM2), and complexity model of PC utilisation (MPCU) embody the concept of effort expectancy. The concept of social influence is described as the "degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2004:451). The determinant social influence corresponds to subjective norm from TRA, TAM2, and theory of planned behaviour (TPB); social factors in MPCU; and image in innovation diffusion theory (IDT). Facilitating conditions are described as the "degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2004:453). This definition embodies the concepts of perceived behavioural control (TPB), facilitating conditions (MPCU), and compatibility (IDT). These concepts are operationalised to incorporate technological and/or organisational environment aspects.

4.2.4 System-determined, interaction and people-determined theories

In the system-determined theory, resistance or non-utilization is attributed to intrinsic features of the implemented system. Explanations in line with this theory are that people oppose systems with technical deficiencies, systems with poor ergonomic design, and systems that lack user friendliness. The system-determined theory predicts that acceptance or resistance of a given system in any organization is attributable to its design features. The underlying assumption of the system-determined theory is that non-utilization is an attribute of system users (Myers & Avison, 2002).

The interaction theory attributes resistance or non-utilization of systems based on an interaction between people characteristics and system characteristics. An explanation drawn from the interaction theory is resistance arising from interaction of the system's technical design features with the social milieu in which the system is used. The underlying assumption for the interaction theory is that non-utilization is a result of the setting, system users and system designers. The interaction theory can explain dissimilar outcomes for system implementations in diverse settings. The interaction theory can also explain dissimilar reactions by the same user group in diverse settings (Myers & Avison, 2002).

The people-determined theory includes inherent people characteristics, for example, cognitive style, personality traits, and human nature. The people-determined theory assumes that resistance is a characteristic of the system user (Myers & Avison, 2002).

The system-determined, interaction theory and people-determined theories are alternative theories. The system-determined theory predicts that if the system features and non-functional system characteristics are modified and/or improved, this would have a positive impact of increased and effective utilization (Myers & Avison, 2002). The interaction theory predicts that changing (improving) technical design may not have much effect on effective utilization and positive user experience but rather other relevant organisational phenomena might provide an explanation for lack of success (Myers &Avison, 2002). The people-determined person predicts change the people involved and the resistance will disappear.

4.2.5 Task-technology fit

Task-technology fit can be described as the "degree to which systems characteristics match user task needs" (Goodhue, 2009:1827). Technologies are seen as tools to be used by people to carry out their tasks. Tasks are defined as actions performed by people in converting inputs into outputs. The task-technology fit viewpoint suggests that a match between system's functions, task needs, and user abilities will bring about improved performance that is, efficient and effective task execution (Goodhue, 2009).

The work done by McGill, Klobas and Renzi (2008) used Goodhue and Thompson's (1995) technology-to-performance chain (TPC) model as a basis to test a research model examining the influence of task-technology fit (TTF) and VLS utilization levels on the performance impact of VLS for educators. Utilisation was both a dependent and independent variable in this study. The application of TTF to lecturer use of a VLS represents the capability of the VLS to support the lecturer in teaching and course administration tasks at the same time as accepting the varied information technology skills of lecturers. This study did not model task, technology or individual differences but instead assumed it was adequate to know a lecturer's assessment of TTF to examine the influence of TTF on use and performance effect.

4.3 The influence of pedagogic, organisational, user difference and demographic factors on VLS usage

This subsection discusses pedagogic, organisational, user difference and demographic factors and their influence on VLS usage.

4.3.1 Pedagogic factors

Pedagogy refers to the science or profession of teaching. This section covers characteristics of online teaching, pedagogic features and challenges.

4.3.1.1 Characteristics of online teaching

Effectiveness is one of the characteristics used to describe the construct ‘quality in use’ (ISO/IEC 9126-1), which refers to the user’s view of the quality of software in use in an environment (Jung, 2007:654). According to Carmean and Haefner (2002), effective online courses are contingent on appropriate tool use, suitable pedagogy, pertinent content, and a re-conceptualization of the roles of students and instructors (Barron, 2003). The findings of a study conducted by McGill and Klobas (2009) confirms that a VLS enhances communication and coordination, but creates more work. According to Martin (2008), the use of virtual learning systems for online and blended course delivery has made flexible learning and teaching possible. Access to course material, assignments and grade book at any time and any place was considered a significant feature of a VLS. The findings of a study on blended learning (BL) from a student perspective were as follows: allows students to work at their own pace and have easy access to the web for scheduled activity; is good for certain subjects; requires self-direction; depends on personal learning style; needs a learning community, needs clear ground rules and on-going support from the tutor; involves competence, requires confidence and involves barriers (Greener, 2008). According to Oliver (2001), a flexible learning environment is created when students have access to discussion forums, chat facilities, electronic group work storage facilities, and recourse to online copies of course documents, lecture notes, assignments, worksheets, syllabi and so on. Flexibility and convenience were some of the strengths reported of online learning (Song, Singleton, Hill & Koh, 2004).

4.3.1.2 Pedagogic features

a) Pedagogic approaches and learning theoretical frameworks applied to e-learning systems

Brown and Peterson (2008) provided the following differentiation of teacher and learner centred approaches, which have implications for the design of learning environments such as VLSs. Teacher centred approaches reveal beliefs and practices where lecturers have prime responsibility for decisions on knowledge content, knowledge representation, and knowledge assessment (Brown & Peterson, 2008:192). Learner centred approaches, on the other hand, reveal practices where lecturers are still primarily responsible for defining the knowledge content, but learners determine how learning takes place and how knowledge is represented. Learning centred approaches are of the view that an instructor cannot solely determine what an individual will need to know. To this end, students should be given the power to decide on what is to be learned, how learning should be represented, and the limitations of that learning (Brown & Peterson, 2008).

Pedagogic approaches have evolved from the transmissive/assisted approach evident in learning 1.0, to the collaborative approach used with online education, and the peer to peer approach used in e-learning 2.0 aimed at creating collaborative groups that "share knowledge and experience to enable the whole group to grow" (Gonella & Pantò, 2008:4).

According to Siemens (2005:3), "behaviourism, cognitivism, and constructivism" were the underlying learning theories for the development of instructional environments. These theories, however, were relevant for the period when technology did not impact the learning. Behaviourism, cognitivism, and constructivism try to answer the question 'how is it a person learns?' Behaviourism states that learning is largely inexplicable as one does not know what is happening in someone's mind (the "black box theory"), and assumes that learning is about a change in behaviour. Cognitivism adopts an information processing model where learning is considered "a process of inputs, managed in short term memory, and coded for long-term recall" (Siemens, 2005:4). Cognitivism is the underlying theoretical framework for e-learning 1.0, which focuses on how the mind represents knowledge (Gonella & Pantò, 2008). Constructivism suggests that learners build knowledge by trying to comprehend their experiences (Siemens, 2005). Behaviourism and cognitivism both view knowledge as outside the learner and learning as the process of acquiring knowledge. Constructivism believes that learners actively engage in activities and thereby construct meaning. Constructivist principles admit that real-life learning is a messy and complex process. Classrooms, which imitate the "fuzziness" of this learning, will be more valuable in facilitating life-long learning (Siemens, 2005:5). The frame of reference for online education is constructivism, which emphasises the active part students play in the teaching and learning process (Gonella & Pantò, 2008). Even social constructivism, which proposes that learning is a social process, acknowledges the role of the individual's brain in learning. These theories do not explain learning that occurs outside of people that is 'learning that is stored and manipulated by technology' (Siemens, 2005:5).

Connectivism presents a model of learning that accepts that learning is no longer an individual activity. The utilisation of tools changes the way people work and function. Connectivism provides an understanding into 'learning skills and tasks needed for learners to flourish in a digital era' (Siemens, 2005:9). The theoretical framework for e-learning 2.0 is connectivism (Gonella & Pantò, 2008). Connectivism has implications for design of learning environments (Siemens, 2005). According to Bonaiuti (2006), connectivism criticises the main learning theories, synthetically identifiable as behaviourism, cognitivism and constructivism, as "incapable of providing a suitable theoretical support to the demands of modern on-line learning modalities". Connectivism views the learning process as a set of connections, which make access to knowledge possible.

b) Instructional design with the use of technology

Chickering and Gamson (1987), as discussed in (Wyles, 2004b), proposed seven principles for guiding effective teaching. Chickering and Ehrmann (1996), as discussed in (Wyles, 2004b), added technology to the seven principles, as illustrated in Table 4.1, so that technology was used in line with the seven principles.

Table 4.1: Seven principles of pedagogy and technology selection (Wyles, 2004a)

Seven Principles	Technology As Lever	Tools for evaluation (examples only)
a) *'Encourage contacts between learners and faculty'* (Wyles, 2004b:4).	Asynchronous and synchronous means of communication lead to increased contact between faculty and learners.	"Email, bulletin boards, forum, chat" (Wyles, 2004b:4). Refer to "Communication tool functions" in *Table 2.1*.
b) *'Develop reciprocity and cooperation among learners'* (Wyles, 2004b:4).	The use of internet tools promotes interaction among learners that are geographically separated, thereby building a community of learners that are not bound by time or physical constraints.	"Chat, forums, instant messaging, blogging, resource pooling/sharing, online community sites and resources" (Wyles, 2004b:4). Refer to "Communication tool functions" and "Content authoring, delivery and management functions" in *Table 2.1*.
c) *'Use active learning techniques'* (Wyles, 2004b:4).	Learners can use a variety of tools to engage in active learning.	"Online games, simulations, interactive tools, quizzes" (Wyles, 2004b:4). Refer to "Student Involvement tool functions/services" and "Assessment/ progress tracking and reporting" in *Table 2.1*.
d) *'Give prompt feedback'* (Wyles, 2004b:5).	Software can provide immediate student feedback.	"Online tutorials, quizzes, online assessments, self-assessment tools" (Wyles, 2004b:5). Refer to "Assessment/ progress tracking and reporting" in *Table 2.1*.
e) *'Emphasise time on task'* (Wyles, 2004b:5).	Technology use allows learners to learn anytime anywhere without having to travel and improves the learner productivity.	"Flexible and intuitive course design, scheduling and completion, online monitoring tools for student's progress" (Wyles, 2004b:5). Refer to "Course administration and management functions/features" and "Assessment/ progress tracking and reporting" in *Table 2.1*.
f) *'Communicate high expectations'* (Wyles, 2004b:5).	The expectation of publishing work artefacts motivates learners.	"Online Web tools for content creation/management/publishing for learners; e.g., Web Blogs, Wikis" (Wyles, 2004b:5).

Seven Principles	Technology As Lever	Tools for evaluation (examples only)
		Refer to "Content authoring, delivery and management functions" in *Table 2.1*.
g) *'Respect diverse talents and ways of learning'* (Wyles, 2004b:5).	Technologies can provide learners with many ways of learning.	"Personalisable online environment providing content media and interactive choices" (Wyles, 2004b:5). Refer to "Course administration and management" and "Content authoring, delivery and management functions" in *Table 2.1*.

Mcgee and Green (2008:153) evaluated a number of VLSs, namely, Angel, Blackboard, Educator, Moodle and WebCT with regard to general support for learning principles, and reported that all systems had many communication functions, namely, chat facility, discussion forums, and whiteboard. Educator had more additional capabilities such as instant messaging (IM), 'virtual office hours' and 'who's online'. All systems evaluated supported a repository for storing and publishing files, while some supported file sharing. Educator offered advanced lesson capabilities with branching paths based on learner performance. Services, such as book-marking and note-taking, were limited or missing. All systems had a variety of online assessment tools, with Educator offering additional capabilities, namely, practice assessments and linking learners to relevant content, once assessments were completed.

Neal and Miller (2005) emphasised the effectiveness of online discussion forums for sharing of ideas and knowledge among students. The pedagogic challenge is to stimulate discussion by eliciting the appropriate amount and type of student participation. A provocative question or statement posted by a lecturer may be used to start the dialogue. Students can also be prompted to post reactions/reflections to specific topics (Barron, 2003). Students are often motivated to participate in academic or real-world discussions when a mark is awarded for participation (Neal & Miller, 2005).

There are many synchronous real-time interactive tools that can be used to lend support to distance education. Most of these tools have an added advantage that these synchronous interaction sessions can be saved for subsequent viewing. Technologies to support synchronous delivery of courses include 'audio conferencing, electronic whiteboards and screen sharing, instant messaging (IM), text chat, virtual worlds, video communication, as well as web casting and web conferencing' (Neal & Miller, 2005). IM and chat allow teachers to publish office hours for online consultation. IM allows students to check for availability of teachers to answer questions and is faster and simpler than other forms of communication. It allows students to easily collaborate with other students on a project. Furthermore, these tools reduce the isolation effect experienced with distance education, as students are able to see who else is online and communicate with them if they so desire (Neal & Miller, 2005). Whiteboard tools can be used for writing, sketching and pointing to information. A range of whiteboard tools are available from simple shared graphical editors to shared applications with acoustic, slide presentations, or remote desktop applications. More sophisticated whiteboard tools have the following capabilities: 'graphing, polling, group web browsing, and instructor moderation' (Neal & Miller, 2005). A teacher can share an open desktop application with a class with screen and application sharing technologies. Many web casting tools package "application sharing, whiteboard, chat, a participant list, polling, and feedback indicators such as hand-raising with audio and video capabilities to provide a virtual classroom" (Neal & Miller, 2005). The chat tool provides a mechanism for students and lecturers to interact in real-time and for lecturers to address student queries (Wcet, n.d.-a). According to Barron (2003:137), chat rooms and the whiteboard facility are used for "group collaboration and for virtual office hours". Botturi (2004) makes mention of the tools for collaborative design projects (typical of CSCL) and tools for peer collaboration.

The tools offered by web 2.0 include "blogs, wikis, social bookmarking, podcasts, collaborative conceptual maps, web feeds and tagging" (Gonella & Pantò, 2008:5). The new approach involves using these tools directly online since some of these tools can be incorporated into e-learning platforms (Gonella & Pantò, 2008). Gonella and Pantò (2008) made the observation that a single tool is not sufficient and that the interests of the user might best be served by connecting different functionalities in a set of tools.

While audio conferencing is a simple and relatively inexpensive way to hold discussions in a course, poor quality audio can pose a barrier to effective communication. Speakerphones with mute capabilities assist student participation with the telephone system, and headsets with microphones facilitate student participation for voice over Internet Protocol (VoIP). Audio sessions conducted should not exceed two hours in length. The classroom experience is difficult to replicate online, even with high quality audio, hence, students should familiarize themselves with topic readings before they engage in online discussion sessions. Students should, therefore, be responsible for their self-study work. Audio sessions should be varied to suit the class size, and simple protocols should be used when participating in discussions. Audio works best when combined with other technologies for sharing and exchanging information (Neal & Miller, 2005). Such technologies should allow lecturers to stream video from within the system or enable videoconferencing between lecturers and learners. Fast connections, however, are a pre-requisite to prevent lengthy delays or poor quality video. The pre-requisite for multipoint videoconferencing is that all participants have access to video cameras, which may not be feasible when students are logging in from home. Streaming video is becoming common and is often replayed rather than live (Neal & Miller, 2005). An assistant or moderator is needed if a text chat is used as it is difficult to converse with a class and monitor a chat at the same time. A well run chat session requires preparation and scripting and if a polling tool is used, questions need to be entered in advance (Neal & Miller, 2005). Streaming live lectures is a constructive education strategy as it creates an interactive online environment for learners (Disbrow, 2008). Voice and videoconferencing systems that have synchronous and asynchronous capabilities are useful for online teaching support.

Virtual worlds are useful for teaching languages, architectural design and informal social interaction (Neal & Miller, 2005).

Functions/features identified for incorporation into a VLS were as follows:

- Progress indicators, which can be used to set standards, present feedback on progress and help students to pace themselves (Neal & Miller, 2005).
- Support tools for student management such as 'exercises, reference materials, labs, tests' as well as student collaboration (Elementk, 2003).

Pedagogic aspects identified for inclusion in a VLS were as follows:

- Support for personalized e-learning (Wan et al., 2005).
- Ability to add learning objectives, course outcomes, assessment criteria and give feedback on achievements (Neal & Miller, 2005).
- Set activities for material posted online so that students can actively engage with course materials (Oliver, 2001).
- Plan activities for online teaching by setting course/topic goals; developing strategies with Internet's capabilities in mind; listing the resource materials; and selecting tools that can help to achieve set goals (Oliver, 2001).
- Set instructional strategies such as 'project-based learning activities, online debates, group presentations, or a multitude of other options' (Barron, 2003:136).
- Design online courses that are akin to teaching in a library with links to online databases, online journals and a wealth of resource material.
- Use management techniques such as encouraging students to answer each other's queries (via e-mail or bulletin board) and use a frequency asked question (FAQ) list to help limit the number of posts.
- Manage information through system features such as "online grade books, course-specific e-mail, assignment-specific digital drop boxes, and file management capabilities" (Barron, 2003:137);
- Identify learning styles to ensure the instructional process considers the learners' differences (Yang, 2008).

- Design e-learning systems to accommodate differences in learning style, prior knowledge, and culture (Vovides et al., 2007).
- Use "Scaffolding and assisted learning" in learning systems" (Egert et al., 2009:454).
- Identify the specific needs of programmes or departments for e-learning tool usage (Wyles, 2004a).

The literature on pedagogic aspects clearly demonstrates the need to understand the role of pedagogic factors on VLS usage in higher education.

4.3.1.3 Pedagogic challenges

Some of the pedagogic challenges highlighted were as follows:

- Revisit teaching methods and processes in order to successfully adapt and extend the technology to fit the educational context (Ellaway et al., 2003) as discussed in Britain and Liber (2004).
- Add missing support for the learning theories to VLSs so as to cultivate more and improved learning (McGee, Carmean & Jafari, 2005).
- Revisit the design of some VLSs, which is based on building metaphors, such as "corridors" and "rooms" for organisation of activities. A platform that relies on a classroom metaphor is no longer appropriate for "breaking out of" the classroom (Beck, 2005).
- Lack of a sense of community and/or feelings of isolation; a lack of immediacy in responses in the online context (Song et al., 2004:62).
- Does not cater for differentiated learning, that is the same tutorial material is presented to all students without taking cognizance of different incompetencies and learning strategies (Vovides et al., 2007).
- Students reported that they did not think that a VLS created 'a social network' similar to social media systems they use (Egert et al., 2009:457).
- There is a gap between a VLS and web 2.0, which prevents digital content hosted in a VLS to reach a global audience through web 2.0 services. In addition, this content is not picked up by classic search engines (Google, Yahoo), and social search services (Technorati, Google Blogsearch, Podzinger). Hence, the public at large does not benefit from the work of academics (Alexander, 2008).
- Lecturers generally teach the way they were taught by using a traditional one-many teaching model based on class lectures and discussion. This model is ingrained in most university cultures, where teaching rewards are based on the quality of lectures and classroom discussions. This conventional teaching model is designed into many e-learning products (Dutton, Cheong & Park, 2004).

- Another university ingrained culture is the norm set for the number of lecturer-student contact hours. Hence, innovations in online teaching could easily lead to the misperception that a lecturer does not have sufficient contact with his or her class (Dutton, Cheong & Park, 2004).
- The cost of additional work involved in changing ingrained practices of teaching (Beck, 2005).
- The limitations of online testing, in that assessment tools serve the purpose of measuring students' performance rather than providing opportunities for further learning, and often involve the use of objective online assessments as opposed to embracing other assessment techniques testing a wider range of intellectual proficiency (Chiheb, Faizi & Afia, 2005).

The literature on pedagogic challenges illustrates the need for understanding the role of pedagogic challenges on VLS usage in higher education.

4.3.2 Organisational Factors

Organisational factors considered for this study are similar to the facilitating conditions used in UTAUT. Facilitating conditions are described "as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2004:453). University support was identified as one of the critical success factors for e-learning (Selim, 2007). A few theoretical and empirical studies showed the influence of organization factors on lecturer's acceptance of a VLS (Al-Busaidi & Al-Shihi, 2010).

4.3.2.1 Organisational and technical support

The findings of studies presented by McGill and Klobas (2009) showed that facilitating conditions did not influence VLS utilisation. Since lack of technical and financial support have been mentioned as important inhibitors to lecturer use of VLSs by McGill et al. (2008), the role of facilitating conditions as a determinant of utilization needs to be considered. The issues of technical support overlaps with user difference factors as different users require different levels of technical support and organizations are the main providers of technical support. Lecturer acceptance of VLSs is dependent on the institutional provision of technical support, "in form of computer specialists, instructional design specialists and trained assistants" (Al-Busaidi & Al-Shihi, 2010:5). Technical support was reported to encourage a favourable attitude toward computer use (Al-Busaidi & Al-Shihi, 2010). Finally, end-user training through mechanisms such as workshops, online tutorials, courses, and seminars was considered important for lecturer acceptance. According to Teo (2009), facilitating conditions, namely, "technical support, training and administrative support "have an indirect effect on teachers' acceptance of educational technology" (Al-Busaidi & Al-Shihi, 2010:5). The success of e-learning is contingent on technical support provision. According to Selim (2007), university administration support is crucial to the success of e-learning. According to Morgan (2003), one of the drivers for encouraging staff already using a VLS to use the system more often or more extensively was training in the use of specific tools such as discussion boards or quiz tools and pedagogical application of virtual learning systems.

4.3.2.2 Instructional design and development support

According to Britain and Liber (2004), academic staff need more professional development in order to use the VLEs for teaching and learning activities beyond regular tasks such as announcements, content delivery and web links. Lecturers who show little understanding of how to engage students using discussion forums, how to organise students' online interactions, or how to integrate online aspects of the course with other learning activities, will have minimal effect on students' learning experience.

Instructional designers are needed to help lecturers exploit the functionality of VLSs. It is incumbent on institutions to provide the necessary support and ensure the quality and rigor of learning with technology (Mcgee & Green, 2008).

The role of the lecturer in a VLS changes to that of a 'guide, coordinator, facilitator, and coach of the learning process' (Vovides et al., 2007:72). In addition, lecturers need technical support and training to acquire the required competency to use a VLS to its full potential for learning and assessment outcomes (Vovides et al., 2007).

It is, therefore, important that higher education institutions devise an e-learning strategy with the required support structures and specialized personnel to stimulate and oversee VLS usage as a learning tool as opposed to a content delivery mechanism. This support team should comprise "instructional designers, graphic designers, multimedia specialists, programmers, and information system specialists" responsible for e-learning course materials design and development, as well as maintenance and service of VLS hardware, software, and network (Vovides et al., 2007:72). Training programmes such as seminars, tutorials, conferences, etc. would empower lecturers to design e-learning courses and learn how to effectively use VLS features (Vovides et al., 2007:72). According to Nanayakkara (2007), large institutions should be equipped with a learning technologies unit offering instructional development services such as training staff members to use e-learning software, assisting them in understanding online pedagogy, assisting them with instructional design, and helping them develop courses.

4.3.2.3 Physical Resources

According to Selim (2007), a stable and reliable university IT infrastructure capable of hosting online courses with the necessary tools to ensure a smooth delivery process is a critical success factor of e-learning. IT tools include "network bandwidth, network security, network accessibility, audio and video plug-ins, courseware authoring applications, Internet availability, instructional multimedia services, videoconferencing", and virtual learning systems (Selim, 2007: 399).

The importance of a substantive infrastructure to make a VLS a functioning tool was iterated by (Beck, 2005). This technical infrastructure should provide reliable service in low and high usage periods, as well as development capabilities and adequate provision of technical equipment.

4.3.2.4 Management support

Senior managers' support also plays an important role in lecturer acceptance and adoption of a VLS in their teaching. Management support of end-users significantly improves computer usage (Al-Busaidi & Al-Shihi, 2010).

4.3.2.5 Organisational challenges

Some of the organisational challenges highlighted were as follows:

- Inadequate provision of technical equipment as is the case with limited numbers of personal computers and limited bandwidth to the (external) server (Beck, 2005).
- Funding for expensive commercial VLS licences and teacher training or updates (Beck, 2005).
- Students perceptions of barriers to blended learning namely "ICT access problems, unfamiliarity with the technology, potential isolation during online weeks, lack of user friendliness and possible cost issues regarding internet connection time from a home computer" (Greener, 2008:245).
- The problem of the end-users' knowledge or learning burden are barriers to diffusion. This implies that institutions must design innovative systems, and implement institutional mechanisms for reducing this learning burden on end users (Attewell, 1992).
- Training educators in VLS usage is a challenge facing technology administrators (Morgan, 2003). Educators need support and extensive training in the features and functions of a VLS, so that the system is put to effective educational usage. One of the major factors inhibiting VLS use by lecturers is lack of technical support (McGill et al., 2008).
- Students must have adequate access from other places than campus in order to benefit from the flexibility of time and distance with online courses. It should also be borne in mind that 'PC and internet access varies with income and education level" (Beck, 2005:176).
- Many institutions invest a large amount of money in e-learning development but lack an enterprise-wide strategic approach for e-learning development across the organization (Nanayakkara, 2007).

4.3.3 User difference factors

According to Hubona, Kennick and Stanley (1996:173), the external variable "individual" is an important factor to consider for new information technology adoption. The direct and the indirect influence of individual characteristics on usage behaviour must be measured. The findings of a study conducted by (Hubona et al., 1996:173) suggest the importance of 'a fit between individual characteristics and the technology'. The findings of a study conducted by Burton-Jones and Hubona (2005) showed that the direct effect of specific individual difference variables significantly improved the explained variance in information technology (IT) usage measures. According to Trice and Treacy (1988), individual differences affect beliefs, which, in turn, affect attitudes, intentions, and information system usage.

Individuals in the context of this study refer to users of virtual learning systems. There are various categories of users namely learners, peer teachers or lead teachers who are in charge of the design and delivery of a course. This study focuses on the user category of teachers and considers user differences among teachers as a factor influencing VLS usage in higher education.

4.3.3.1 Computer comfort level and experience

Computer self-efficacy can be defined as "individuals self-assessment of their ability to apply computer skills to accomplish their tasks" (Al-Busaidi & Al-Shihi, 2010:4). Many studies reported a significant correlation between computer self-efficacy and perceived usefulness on an information system (Vankatesh & Davis, 1996; Al-Busaidi & Al-Shihi, 2010).

Categorization of end users' computer literacy can be based on whether they were comfortable in creating spreadsheets, generating reports or writing simple applications (Goodhue, 2009).

According to Venkatesh and Davis (2000), experience with the use of technology (EUT) plays a key role in technology acceptance (Al-Busaidi & Al-Shihi, 2010). An individual's EUT refers to "an individual's exposure to the technology as well as the skills and abilities that s/he gains through using technology" (Al-Busaidi & Al-Shihi, 2010). Another people factor cited by Song et al. (2004) is comfort with online technologies, which learners reported to be useful in online learning.

4.3.3.2 Teaching preference

While the role of the lecturer's teaching style in technology acceptance has not been fully examined, it has been identified as a potential factor in the literature (Al-Busaidi & Al-Shihi, 2010). Three characteristics of lecturers have been suggested to have an effect on e-learning success: '(1) IT competency; (2) teaching style; and (3) attitude and mind-set' (Selim, 2007:398).

4.3.3.3 Experience of online teaching

a) Comfort and effectiveness of online delivery

Findings pertaining to learners' perspectives of online technology are as follows: it 'allowed more reflection than what might occur for some individuals in face-to-face classroom discussions' and asynchronous forums allowed them to think more deeply when responding in writing (Song et al., 2004:61). Experience of online teaching here indicates the effectiveness of VLS for reflective and social learning.

b) Effort involved in online classroom

One of the major VLS utilization and performance impact themes reported from the qualitative analysis of the study conducted by McGill et al. (2008) was that a VLS creates more work.

c) Ease of communication

According to Al-Busaidi and Al-Shihi (2010), a VLS can improve the effectiveness of communication between users.

4.3.3.4 User difference challenges

The main inhibiting factors described in the literature were as follows:

- Time needed to "learn to use" a VLS (McGill et al., 2008:649).
- Learning to use a system and preparing materials for it was found to precede more interactive and collaborative uses of the tool (Oliver & Moore, 2008).
- Time requirements for "online teaching" (McGill et al., 2008:649).
- A large initial investment of time was required to reap benefits (McGill et al., 2008:649).
- Lack of "technical support" from a user perspective with some users requiring more technical support than others (McGill et al., 2008:649).
- Issues around the "quality of courses" (McGill et al., 2008:649).
- Funds to support "development of courses" (McGill et al., 2008:649).
- Fear of technology presented a barrier to adoption and subsequent usage, where it was found that professors in the arts and humanities felt that they do not possess the ability nor did they have the time to learn to build web-based course material (Hueh & Hsu, 2008).

4.3.4 Demographic factors

The demographic variables that were examined in this study included subject discipline, academic rank, name of VLS used, academic levels taught, actual system experience measured as the length of VLS usage in years, and the number of distinct online/blended courses taught. Oliver and Moore (2008) found that experience may play an important role in the web tools that faculty employ as the faculty trend was to add tools to their repertoire.

4.4 Implications of theories and factors for this study

The system-determined, interaction and people-determined theories were customized to study usage behaviour rather than resistance behaviour. This meant that the assumptions of these theories were modified to fit usage behaviour. These theories were synthesized with Roger's innovation diffusion theory. The constructs of Roger's innovation diffusion theory, namely, relative advantage were linked to non-functional system characteristics, and compatibility was linked to the user needs as well as compliance with standards in this study. The concepts of perceived usefulness and perceived ease of use represented in TAM was affiliated with systems factors in this study. The construct, namely, 'facilitating conditions' from the UTAUT model was represented as organisational factors in this study. The task technology fit model was represented as the pedagogic factors in this study. The user characteristics concept discussed under the utilisation framework were represented as user difference factors in this study. The 'compatibility belief of prior experience' was represented as the demographic factor of system experience in this study. The review of the theories/models led to the selection of six influential factors for the study of VLS usage, namely, perceived usefulness corresponding to system functions/features; perceived importance corresponding to non-functional characteristics, pedagogic, organisational, user difference and demographic factors.

The literature on pedagogic factors comprising characteristics of online teaching and pedagogic features was used to examine the relationship between pedagogic factors and actual system usage.

The literature on organisational factors comprising institutional e-learning support was used to examine the relationship between organisational factors and actual system usage.

The literature on user difference factors comprising users' computer comfort level, teaching style preferences and experiences of online teaching was used to examine the relationship between user difference factors and actual system usage.

The literature on the demographic factor system experience was used to analyse its role on actual system usage. Other demographic variables identified in section 4.3.4 were also examined.

In addition, the literature makes reference to possible pedagogic, organisation and user difference challenges that could impact actual system usage. These relationships were examined in the empirical part of the study to ascertain whether educators' perceptions on existing pedagogic, organisational and user difference challenges influenced actual system usage.

4.5 Initial theoretical framework

According to Sekaran and Bougie (2010), the theoretical framework is the foundation on which the entire research study is based. The relationship between the literature review and the theoretical framework is that the former provides a solid foundation for developing the latter. It is recommended that a theoretical framework should have three basic features (Sekaran & Bougie, 2010):

- Definition of variables considered relevant to the study.
- A conceptual model that describes the relationships between the variables.
- A clear explanation why these relationships are expected to exist.

The definition of the themes or categorical independent variables, namely, VLS factors and concomitant factors of perceived usefulness and perceived importance, pedagogic factors, organisational factors, user difference factors, demographic factors and the global theme or dependant variable actual system usage relevant to this research was provided in Chapters 1, 2, 3 and 4.

A conceptual model describing the relationships between the themes/categorical variables is provided in Figure 4.1.

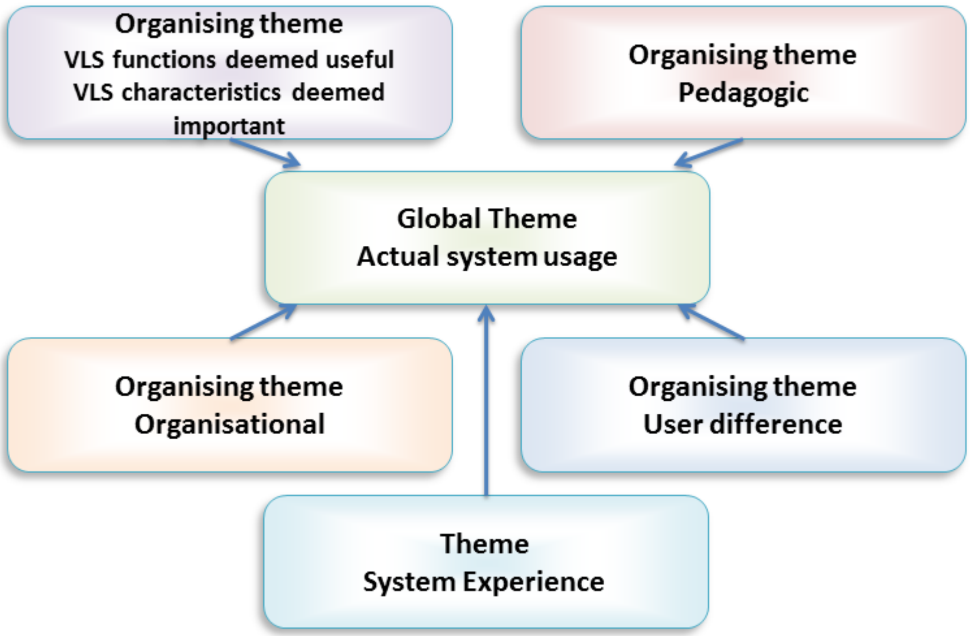

Figure 4.1: Schematic diagram of initial theoretical framework for VLS

According to Trice and Treacy (1988), the amount of usage an individual or group or organization makes of an information system is a key variable in management information system (MIS) research. The phenomenon being studied is the usage of VLSs by educators in higher education. Hence, this study focused on actual system usage as a global theme (using a qualitative approach) or dependent variable (using a quantitative approach). The literature review in Chapters 2 and 3, point to the relevance of system factors comprising generic and system specific functions/features as potential factors influencing VLS usage. Literature findings in this chapter point to the possible influence of perceived usefulness/perceived importance as well as pedagogic, organisational, user difference and demographic factors on actual system usage. These factors are the themes or independent categorical variables and the relationships between the themes (independent variables) and the global theme (dependent variable) were analysed in the empirical part of the study which is discussed in Chapters 6 and 7.

This research on the technical and non-technical factors that influence VLS usage in higher education was based on a number of *referent theories* applied to the field of e-learning, namely, the theory of reasoned action (TRA); theory of planned behaviour (TPB); technology acceptance model (TAM); unified theory of acceptance and use of technology (UTAUT); innovation diffusion theory; system, interaction and people-determined theories of non-utilisation; task-technology fit; and Lewin-Schein model of change management (Davis,1989; Venkatesh, Morris, Davis & Davis, 2004; Rogers, 1995; Myers & Avison, 2002; Goodhue, 2009; Schein,1996).

The initial research propositions for this research are presented below:

a) Beliefs about the usefulness of the system's functions/features influence actual system usage in higher education.
b) Beliefs about the importance attached to the system's non-functional characteristics influence actual system usage in higher education.
c) Pedagogic themes namely the characteristics of online teaching, pedagogic features, and challenges influence actual system usage in higher education.
d) Organisational themes namely e-learning support and challenges influence actual system usage in higher education.
e) User difference themes namely experience of online teaching, computer comfort level, and teaching style preference influence actual system usage in higher education.
f) Demographic themes namely system experience (measured as length of VLS usage in years and number of distinct online/hybrid courses taught) influence actual system usage in higher education.

4.6 Summary

This chapter reviewed the theories relevant to e-learning, and other non-technical factors that bear an influence on VLS usage behaviour. These non-technical factors include pedagogic, organisational factors, user difference and demographic factors.

The theories reviewed in this chapter were as follows: the theory of reasoned action (TRA); theory of planned behaviour (TPB); technology acceptance model (TAM); unified theory of acceptance and use of technology (UTAUT); innovation diffusion theory; system, interaction and people-determined theories of non-utilisation; task-technology fit; and Lewin-Schein model of change management.

The literature review of factors from a pedagogic perspective included characteristics of online teaching, pedagogic features and challenges. The literature review of factors from an organisational perspective included institutional e-learning support and challenges. The literature review of factors from a user difference perspective included teaching style preference, computer comfort level and experiences of online teaching. The literature review of factors from a demographic perspective included system experience.

The next chapter will provide a discussion on the research methodology and design for this research study.

CHAPTER 5: RESEARCH DESIGN AND METHODOLOGY

5.1 Introduction

The literature review presented in Chapters 2, 3 and 4 provided the initial theoretical framework for investigating the factors that influence VLS usage in higher education.

The main aim of this chapter is to discuss the research design and methodology followed in this research in order to answer the study's research questions identified in Chapter 1. The chapter is structured as follows: section 5.2 discusses the research philosophy; section 5.3 discusses the research methods suitable for information systems; section 5.4 discusses the different research methods/ strategies; section 5.5 describes data collection methods; section 5.6 describes data analysis procedures; section 5.7 discusses the research design and methodology for this study; section 5.8 covers the issue of triangulation, which is followed by the chapter summary in section 5.9.

5.2 Research philosophy

According to Myers (1997:3), both quantitative and qualitative research is guided by underlying assumptions on what comprises "valid research", and the appropriateness of research methods. Epistemology refers to the "assumptions about knowledge and how it can be obtained" (Myers, 1997: 3-4).

Myers (1997) proposes three philosophies for qualitative research, namely, positivist, interpretive, or critical as illustrated in Figure 5.1. The research philosophy adopted is independent of the specific research methods chosen. This implies that case study or action research methods can be based on positivist, interpretive or critical research philosophies. These three research philosophies are discussed below.

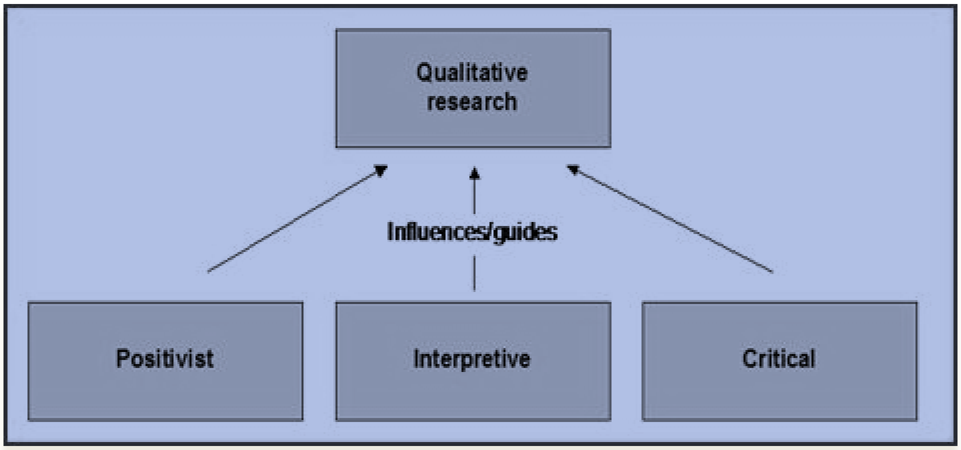

Figure 5.1: Philosophical assumptions underlying qualitative research (Myers, 1997)

5.2.1 Positivist research

"Positivists generally assume that reality is objectively given and can be described by measurable properties, which are independent of the observer (researcher) and his or her instruments" (Myers, 1997:5). Studies based on the positivist philosophy generally test theory by making predictions about phenomena. According to Orlikowski and Baroudi (1991), as discussed in Myers (1997:5), IS research based on the positivist philosophy is operationalized by "formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population". The primary data collection techniques used are surveys and controlled experiments, and the data analysis method used to reveal contributory laws is inferential statistics (Myers, 1997).

The criteria for conducting scientific research, namely, validity, and replicability is incorporated in the positivist research paradigm.

5.2.2 Interpretive research

"Interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings" (Myers, 1997:5). Interpretive research is underpinned by the philosophical basis of hermeneutics and phenomenology. Interpretive studies are aimed at understanding phenomena through the meanings assigned to them by people and interpretive methods of research in IS are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Myers, 1997). Interpretive research does not identify "dependent and independent variables" in advance, but rather emphasises "human sense making" within a specific situation or context (Myers, 1997:5).

5.2.3 Critical research

"Critical researchers assume that social reality is historically constituted and that it is produced and reproduced by people" (Myers, 1997:5). Critical researchers concede that while people deliberately act to make social and economic changes, they know that their actions are controlled by various forms of social, cultural and political authority. "The main task of critical research is one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light. Critical research focuses on the oppositions, conflicts and contradictions in contemporary society, and seeks to eliminate the causes of alienation and domination" (Myers, 1997:5-6).

5.3 Research methods and techniques for IS

The discipline that focuses on the development, use and impact of information technology in business and organisational settings is information systems (Myers & Avison, 2002). IS research endeavours are aimed at IS practice, that is, the findings of IS research were planned to enlighten and improve information systems development and usage in organisations. There is an equal and reflexive relationship between IS research and social reality (Myers, 1997).

The following three classes of methods were identified by (Olivier, 2009) for information technology (IT) research:

- Creative methods refer to the category of models, prototypes, algorithms and languages.
- Tautological (manipulation) methods refer to mathematical proofs and arguments.
- Empirical methods include observation, surveys, case studies and experiments. Empirical research is based on observed and measured phenomena and derives knowledge from actual experience rather than from theory or belief (Penn State University| Libraries, 2013).

Myers (1997:6) recommends the "approaches of (i) action research, (ii) case studies, and (iii) ethnography" for qualitative research in information systems. The relevance of each of these methods for IS research is discussed below:

- *Ethnographic research* is suitable for information systems studies as it can provide an understanding of the "human, social, and organisational aspects of information systems" (Myers, 1999: 2).

- Interpretive *case studies* are appropriate in the IS field, and can contribute to the theory and practice of information systems. (Walsham, 1995). Conducting *case studies* is a standard method of empirical study in management and related disciplines such as organization development and information systems (IS) research (Sjøberg, Dybå & Jørgensen, 2007). Sjøberg et al. (2007) emphasised the need for empirical research methods to produce scientific knowledge on the efficacy of different software engineering (SE) technologies for different actors, performing different activities, on different types of systems, which is related to the design of information systems. It was envisaged that such scientific knowledge will inform SE technology development and important SE decisions. According to Runeson and Höst (2008), *case studies* is deemed as a suitable research method for software engineering as it allows contemporary phenomena to be studied in its natural context.
- *Action research* is another research method where "research informs practice and practice informs research synergistically" (Avison, Lau, Myers & Nielsen, 1999:74). *Action research* has been used in user-centric product development projects (Brandt, 2004). Byrne (2005) advocated the use of action research (AR) as an approach in the designing of information systems (IS).

A quantitative method commonly deployed in the social sciences is the *survey method*, which is applicable to IS research (Myers, 1997). Survey methods are often used for technology acceptance research studies (Karahanna, 2006).

Another research method suited to IS research is *grounded theory*, which was used to study the adoption and use of CASE tools in organisations (De Villiers, 2005).

According to Burton-Jones and Straub (2006:229), researchers in the domain of IS acceptance, study system usage as a behaviour determined by "social and cognitive variables, with the goal of finding variables that explain most variance in usage". Research methods suited for studying VLS usage include all of the above-mentioned empirical methods. This study analyses the role of *system factors* corresponding to concomitant factors of *perceived usefulness and perceived importance*, as well as *pedagogic*, *organisational, user difference* and *demographic factors* in VLS usage. Hence, the study spans the fields of software analysis, human-computer interaction, IS management and social psychology. Research method(s) that are compatible or suited to all of the fields comprising this inter-disciplinary study are eligible for selection.

5.4 Research methods/strategies

Quantitative research methods are used in the natural sciences to study natural phenomena. Examples of quantitative methods accepted in the social sciences include survey methods, laboratory experiments, formal methods and numerical methods such as mathematical modelling (Myers & Avison, 2002).

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena. They are designed to help us understand people and the social and cultural contexts within which they live. Action research, case study research, and ethnography are examples of qualitative methods. Observation, interviews and questionnaires, documents and texts and researchers' impressions and reactions serve as data sources for qualitative research.

According to De Villiers (2005), qualitative findings can be used to prepare hypotheses and questions for quantitative analysis, which can then be tested, verified and extended. Qualitative and quantitative research methods are not mutually exclusive (De Villiers, 2005). The following figure depicts several research methods including both qualitative and quantitative methods that overlap placed on a Positivist – Interpretivist axis.

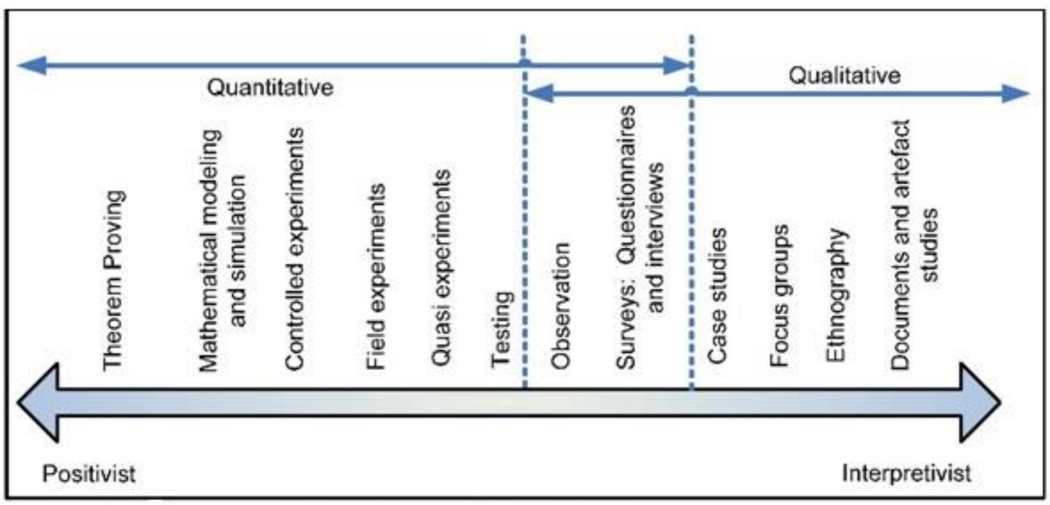

Figure 5.2: Research methods/strategies (De Villiers, 2005)

There are many qualitative research methods just as there are many philosophies that underpin qualitative research. A research method is a strategy that incorporates underlying philosophical assumptions, research design and data collection techniques (Myers & Avison, 2002). The research method influences the way in which the researchers collect data. Different research methods encompass different skills, assumptions and research practices.

Myers and Avison (2002) discuss the following four research methods, namely, action research, case study research, ethnography and grounded theory. Each research method discussed below uses one or more data collection techniques. These techniques include, inter alia, interviews, observational techniques such as participant observation, fieldwork, and archival research. Written data sources consist of "published and unpublished documents, company reports, memos, letters, reports, email messages, faxes, newspaper articles among others" (Myers, 1997:9). A case study researcher typically uses interviews and documentary materials first without resorting to participant observation. Qualitative data collection and analysis produce findings on human values and experiences. The ability to interpret data is important as the researcher acts as an instrument (Leedy & Ormrod, 2005).

5.4.1 Action research

A commonly cited definition of action research is: "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (Myers, 1997). This definition highlights the collaborative aspect of action research and the possible ethical dilemmas arising from its use. Action research is also described as "an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning" (Avison et al., 1999:94). Applied fields such as organisation development and education accepted action research as a valid research method. In information systems, however, action research was largely unused for some time, with notable exceptions (Myers, 1997). There has of recent being a growing interest in action research.

5.4.2 Case study research

The term "case study" has numerous meanings. It can be used to describe a unit of analysis (e.g., a case study of a particular organisation) or to describe a research method (Yin, 2003). This discussion focuses on the use of the case study as a research method.

Case study research is the most frequent qualitative method used in information systems (Myers, 1997). Yin (2003:13) defines the scope of a case study as follows: "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident".

The case study research method is particularly compatible to IS research, since the discipline is concerned with the study of information systems in organizations, and "interest has shifted to organisational rather than technical issues" (Myers, 1997:7). Case study research can be underpinned by positivist, interpretive, or critical philosophies. Lee, as discussed in Myers and Avison (2002), states that a case study satisfies the positivist criteria for scientist research. According to Yin (2003), a case study includes both the phenomenon of interest and its context, thereby producing a number of potentially relevant variables.

5.4.3 Ethnography

“Ethnography research comes from the discipline of social and cultural anthropology where an ethnographer is required to spend a significant amount of time in the field. Ethnographers immerse themselves in the lives of the people they study and seek to place the phenomena studied in their social and cultural context” (Myers, 1997:8). In the area of the design and evaluation of information systems, ethnographers are working collaboratively with designers, IS professionals, computer scientists and engineers. This trend is particularly strong in the UK and Europe and is increasing in the US.

5.4.4 Grounded theory

“Grounded theory is a research method that seeks to develop theory grounded in data that is systematically gathered and analysed” (Myers, 1997:8). According to Myers (1997:8-9), grounded theory is "an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data." In addition, Myers (1997:9) adds that grounded theory is becoming more widespread in the IS research literature because the method is “useful in developing context-based, process-oriented descriptions and explanations of the phenomena”.

5.4.5 Mixed-method research

Mixed methods involves a research design that uses *multiple methods*-more than one research method or more than one research approach, namely quantitative or qualitative (Venkatesh, Brown & Bala, 2013). Saunders, Lewis and Thornhill (2009) differentiate between quantitative and qualitative research approaches as follows: quantitative is mainly used to refer to data techniques such as a questionnaire or data analysis procedure (such as charts or statistics) that produces or uses numerical data, while qualitative refers to data collection techniques such as an interview or data analysis procedure (such as categorising data) that produces or uses non-numerical data. According to Saunders et al. (2009), in mixed method research, quantitative data are analysed quantitatively and qualitative data are analysed qualitatively.

5.5 Data collection methods

Data can be obtained from primary or secondary sources. According to Sekaran and Bougie (2010), primary data refers to information obtained first-hand by the researcher on variables of interest for a specific study while secondary data refers to information gathered by researchers that are published in journals, conference proceedings, websites, as well as information from published or unpublished sources either within or outside the organisation. Primary data can be collected using a variety of ways, namely, interviewing; administering questionnaires; observing people and phenomena; and unobtrusive methods such as document/record extraction, amongst other techniques (Sekaran & Bougie, 2010).

5.5.1 Interviews

Interviews can be structured or unstructured. An unstructured interview does not involve a planned sequence of questions. The objective of an unstructured interview is to probe into several factors in the situation central to the broad problem area. A structured interview is accompanied by a set of pre-determined questions to which answers are elicited from respondents. The questions in structured interviews are focused on factors that are considered relevant to the problem. Interviews can take the form of face-to face interviews, telephone interviews, computer-assisted interviews, and interviews through the electronic media (Sekaran & Bougie, 2010).

5.5.2 Questionnaires

A questionnaire consists of a pre-written set of questions to which respondents record their answers within closely defined alternatives. There are principles that guide the appropriate wording of the questionnaire to minimise bias. In addition, there are principles of measurement to ensure that data collected are appropriate to test the hypotheses. Questionnaires are a popular method as data can be obtained fairly easily and responses can be easily coded. Questionnaires can be personally administered, sent through the mail, or electronically administered through e-mail, via the Internet or an intranet. There are also several software packages for creating surveys that can be administered over the web (Sekaran & Bougie, 2010).

Sekaran and Bougie (2010) provide the following definition of the four basic types of scales that can be used in a survey instrument:

- A nominal scale assigns subjects to certain categories or groups.
- An ordinal scale categorises the variables to denote differences and rank-orders the categories in a meaningful manner.

- An interval scale allows certain arithmetical operations to be performed on the data collected from respondents.
- The ratio scale measures the magnitude of the differences between points on the scale and also taps the proportions in the differences.

5.5.3 Observation

People can also be observed in their natural work environment, or in a lab setting, and their activities, behaviours, emotions or body language can be recorded. The researcher can act as a nonparticipant-observer by collecting data without becoming an integral part of the organisation. On the other hand, the researcher can act as a participant-observer where the researcher enters the organisation and becomes part of the work team (Sekaran & Bougie, 2010).

5.5.4 Multi-method data collection

According to Sekaran and Bougie (2010), multi-methods of data collection lend rigour to research. If, for example data collected through interviews and questionnaires are strongly correlated with one another, then there would be more confidence in the goodness of the collected data.

5.6 Data Analysis

In qualitative studies, “the analysis affects the data and the data affect the analysis in important ways” (Myers, 1997:10). Hence, the use of the term "modes of analysis" as opposed to "data analysis" in qualitative research. These modes of analysis represent the collection, analysis and interpretation of qualitative data. Qualitative modes of analysis deal mostly with textual analysis (whether verbal or written).

The following modes of analysis will be discussed here.

5.6.1 Specific Analytic techniques for Case Studies

According to Yin (2003), patterns in explanatory case studies may be associated with the dependent or the independent variables of study (or both). Pattern matching may also be applied to descriptive case studies, provided that specific variables and their relationships are predicted before data collection. Another analytic technique is a special type of pattern matching where a phenomenon is explained by presuming a set of causal links about it. These causal links are comparable to independent variables (Yin, 2003).

Explanation building, in most case studies, is expressed in narrative form. Since narratives are not precise, case studies explanations that reflect some theoretically significant propositions are considered to be better.

5.6.2 Qualitative Analysis

Two prominent qualitative analysis techniques are presented in the sub-sections that follow.

5.6.2.1 Thematic analysis

Qualitative data in the form of text can be analysed to ascertain participants' "perceptions, feelings, knowledge and behaviour represented in the text" (Guest, MacQueen & Namey, 2012:9). Analysis can be performed using themes and codes. According to Guest, MacQueen and Namey (2012:15), the approach to qualitative data involves " the reduction of texts to codes that represent themes or concepts and the application of quantitative methods to find patterns in the relations among the codes". A theme represents something important about the data pertaining to the research question and some kind of "patterned response or meaning within the data set" (Braun & Clarke, 2006:82). Prevalence of themes can be counted as each individual occurrence of themes across the data sets (Braun & Clarke, 2006). According to Braun and Clarke (2006:83), "themes or patterns can be identified" in an "inductive" or "theoretical or deductive" manner. A theoretical thematic analysis leans towards the researcher's analytic interest in the area and is, therefore, more analyst-driven. Using this approach, the researcher can code for specific research questions, which map onto the theoretical approach. A theoretical approach requires researchers to engage with literature prior to the analysis. The phases of thematic analysis involves "(1) familiarizing yourself with the data; (2) generating initial codes; (3) searching for themes; (4) reviewing themes; (5) defining and naming themes; and (6) producing the report" (Braun & Clarke, 2006:87). Generating initial codes depends on whether the themes are more "data-driven" or "theory driven". The latter approach codes the data with specific questions that the researcher has in mind (Braun & Clarke, 2006). Searching for themes involves collecting all data relevant to each theme, whereas reviewing of themes involves checking if themes work against coded extracts and the entire data set, and generating a thematic map of the analysis (Braun & Clarke, 2006). Braun and Clarke (2006:84) state that the "analytic process involves a progression from description" whereby data is "organized to show patterns in semantic content, and summarized, to interpretation" where an attempt is made to theorise the "significance of the patterns and their meanings and implications" with relation to previous literature. The criteria used for judging themes or categories are homogeneity and external heterogeneity. Data within themes should be cohesive and "there should be clear and identifiable distinctions between themes" (Braun & Clarke, 2006:91). Thematic analysis is a commonly used method of analysis in qualitative research and allows the researcher to capture the complex meanings within a textual data set (Braun & Clarke, 2006; Guest, MacQueen & Namey, 2012). Applied thematic analysis comprise elements where "assertions are required to be supported with evidence (text)", and elements that require identifying themes within text, which is a highly interpretive exercise (Guest, MacQueen & Namey, 2012:17).

5.6.2.2 Cluster analysis

Cluster analysis is an exploratory technique that can be used to visualize patterns in a project by grouping sources or nodes that share similar words, similar attribute values, or are coded similarly by nodes. Cluster analysis diagrams offer a graphical representation of sources or nodes to make it easy to see similarities and differences. Sources or nodes in the cluster analysis diagram that appear close together are more similar than those that are far apart. In this case, nodes representing content categories or themes were compared based on similarity of words (QSRInternational, n.d.).

Themes with a high similarity index (maximum=1) indicate a strong similarity and are displayed closer together on the cluster analysis diagram. Correlation refers to any of a broad class of statistical relationships involving dependence (QSRInternational, n.d.).

5.6.3 Quantitative analysis

Quantitative data analyses include descriptive statistics such as frequencies, charts, inferential and multivariate statistical procedures such as analysis of variance (ANOVA), t-tests, factor analysis, correlational analysis and the reliability coefficient (Sekaran & Bougie, 2010). According to Leedy and Ormrod (2005), descriptive and inferential statistics are types of parametric statistics. Descriptive statistics include "measures of central tendency, variation and correlation" (Leedy & Ormrod, 2005:259). Inferential statistics include "inferences, estimations, predictions and hypothesis testing" (Leedy & Ormrod, 2005:259). Inferential statistics refer to "statistics that help to establish relationships among variables and draw conclusions therefrom" (Sekaran & Bougie, 2010:440). Frequencies refer to the "number of times various subcategories of a certain phenomenon occur from which the percentage and cumulative percentage of their occurrence can easily be calculated" (Sekaran & Bougie, 2010:439). ANOVA refers to "analysis of variance which tests for significant mean differences in variables among multiple groups" (Sekaran & Bougie, 2010:435). Factor analysis refers to a "multivariate technique for identifying whether the correlations between a set of observed variables stem from their relationship to one or more latent variables in the data, each of which takes the form of a linear model" (Field, 2009:731). Cronbach's alpha "is a reliability coefficient that indicates how well the items in a set are positively related to one another" (Sekaran & Bougie, 2010:324). Correlational analysis refers to analysis done to trace the mutual influence of variables on one another (Sekaran & Bougie, 2010:437). A test using the t-statistic establishes whether two means collected from independent samples differ significantly

(Sekaran & Bougie, 2010:446). Additional explanations of the quantitative data analysis techniques are included in Appendix 5. The Statistical Package for the Social Sciences (SPSS) is a data management and analysis program that is used by researchers to analyse quantitative data.

5.7 Research methodology and design for this study

This section covers the research questions, research philosophy, research strategy/method, research design, data collection and analysis techniques, as well as model development and model confirmation implemented for this study.

5.7.1 Research questions

This research study was guided by the main research question, namely:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

In order to address the main research question the following research sub-questions were included:

1. What is/are the extent of usage, frequency of usage, total system usage, and usage clusters for VLSs in higher education?
2. What system factors corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?
3. What pedagogic factors influence actual system usage in higher education?
4. What organisational factors influence actual system usage in higher education?
5. What user difference factors influence actual system usage in higher education?
6. What demographic factors influence actual system usage in higher education?

The research sub-questions are addressed in Chapter 6, section 6.4 and Chapter 7, section 7.12. The combined qualitative and quantitative findings are discussed in Chapter 8, section 8.2, and summarised in Chapter 11, section 11.2.

5.7.2 Research philosophy

This research study adopted the interpretive philosophy. An interpretive study combining qualitative and quantitative approaches was conducted to answer the research question “what factors influence virtual learning system usage in higher education (HE)?” The literature review provided the foundation for the development of an initial theoretical framework which was used in the empirical phases of the study. The categories/themes emanating from phase 3.1 of data collection was analysed and aggregated with secondary data obtained from the literature study. The initial theoretical framework and research propositions were refined accordingly. The refined theoretical framework and research propositions were tested in the phase 3.2 of the data collection using a quantitative approach. Hence, a mixed-method approach was used combining qualitative and quantitative data collection and analysis techniques in a single research design, which was used sequentially, that is, one after the other.

5.7.3 Research strategy/method

This section discusses details of how the research techniques/designs were implemented for this study.

This study implemented a theory-based interpretative case study research strategy. A case study research strategy was deemed most appropriate for this study as it permitted the study of technical, as well as organisational issues pertaining to information systems use in organisations. The case study research strategy was combined with a mixed methods research design using *multiple methods,* in this instance more than one research approach, namely quantitative or qualitative (Venkatesh et al., 2013). Accordingly, quantitative data (i.e., surveys) were analysed quantitatively and qualitative data (i.e., interviews) were analysed qualitatively. This study used thematic and cluster techniques for the analysis of interview data defined in section 5.6.2, as well as descriptive and inferential statistics for survey data defined in section 5.6.3.

A case study research method is advantageous over an experiment in that it covers organisational conditions while an experiment separates a phenomenon from its context. A case study research method also has an advantage over the survey method as a survey is limited in its ability to study the context. This study embraced both the technical and non-technical dimensions by including system factors corresponding to concomitant factors of perceived usefulness and perceived importance, pedagogic factors, organisational factors, user difference factors and demographic factors in studying the phenomenon of VLS usage in higher education.

According to Yin (2003), a study's questions, propositions (optional), unit of analysis, logic linking data to propositions, and criteria for interpreting the findings are the key components of case study research designs. Lee advocates that a case study makes its inferences using verbal propositions (i.e., qualitative analysis) and applies the rules of formal logic. In logic terms, a theory's predictions are its conclusions (Myers & Avison, 2002). The propositions for this study were presented together with the initial theoretical framework in Chapter 4, section 4.5.

5.7.3.1 Role of Theory

According to Yin (2003), theory development plays a role in the data collection phase of the case study, and states that generalisation of the case study occurs at the theoretical level. The role of theory is characterised as “analytic generalisation ”where the empirical results of the case study are compared against previously defined theories (Yin, 2003:32). If the same theory is supported by two or more cases, then replication is achieved. Several theories or frames of reference were applied to this study which were summarised in section 4.4. To address the issue of generalizability, Myers and Avison (2002) hypothesize that theories were generalizable only if confirmed by additional case studies where the same theories are tested against other settings. In this study, the relevant theories were tested in two different settings, thereby improving the generalizability of the results.

5.7.3.2 Validity and Reliability in case studies

According to Yin (2003), four tests relevant to case studies are used to determine the quality of empirical research. A definition of each of these terms is provided together by a discussion on mechanisms that can be used to assure validity and reliability in case study research designs.

a) Construct validity

Construct validity is defined as establishing the right operational measures for the concepts being investigated. To ensure construct validity, mechanisms such as the use of “multiple sources of evidence during data collection, and establishing a chain of evidence” are recommended (Yin, 2003:34). For the purposes of this case study, multiple sources of evidence, namely, the literature review, archival sources in the form of software product specifications, interviews, surveys were used and a chain of evidence was established to assure construct validity.

b) Internal validity

Internal validity is defined as creating a relationship whereby certain conditions are proven to lead to other conditions. To ensure construct validity, mechanisms such as “pattern-matching, explanation-building, addressing rival explanations and the use of logic models” applied during data analysis are recommended (Yin, 2003:34). Internal validity was addressed by analytic tactics such as thematic and cluster analysis defined in section 5.6.2 for qualitative data and inferential statistics defined in section 5.6.3 for quantitative data.

c) External validity

External validity has to do with ascertaining the domain to which a study’s findings can be generalised. Mechanisms for ensuring external validity include “using theory in single case studies, and replication logic in multiple case studies” (Yin, 2003:34). External validity was addressed whereby the relevant theories were tested in a second case study for replication of findings. According to Walsham (1995:79), "four types of generalization can be made from interpretive case studies: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insight". However, generalization should be viewed as an explanation of "particular phenomena, derived from empirical interpretive research in specific IS settings, which may be valuable in the future in other organizations and contexts" (Walsham, 1995:79). Generalisation, in this study, was viewed as an explanation of the phenomena of virtual learning system usage in higher education derived from the empirical interpretive research conducted in two VLS settings.

d) Reliability

Reliability involves demonstrating that a study's operations, "such as data collection procedures can be repeated with the same results" (Yin, 2003:35). Mechanisms' for assuring reliability are the use of a case study protocol and the development of a case study database. In order to address the reliability problem, a case study protocol was used.

5.7.3.3 Case study research design

According to Yin (2003:40), four types of designs for case studies may be used: "single-case (holistic) designs (Type 1), single case (embedded) designs (Type 2), multiple-case (holistic) designs (Type 3), and multiple-case (embedded) designs (Type 4)". A two-case holistic study design was used to conduct this research. A two-case design uses two representative higher education institutions that are typical of many higher education institutions in South Africa. A holistic design does not further segment the two cases under study into smaller units such as schools or departments. Instead the approach used was to focus on educators' perceptions from an organisational perspective.

CONTEXT: HE (UKZN)	**CONTEXT: HE (DUT)**
Educators of diverse disciplines that used or are currently using a VLS	Educators of diverse disciplines that used or are currently using a VLS

Figure 5.3: Case study design

The procedure used for the two-case study was as follows:

- Select relevant theories.
- Select cases + design data collection protocol.

- Conduct first and conduct second case study.
- Write individual case reports.
- Compare cases.
- Confirm or refute theory.
- Make inferences from cases.
- Write cross case summary report.

5.7.4 Data collection and analysis

A literature review was undertaken to establish an initial theoretical framework for the research study. The literature review presented in Chapter 2 helped to identify a list of generic functions/features and non-functional characteristics of VLSs, and understand VLS usage patterns in higher education. A description of instances of functions/features for VLSs Blackboard and Moodle was presented in Chapter 3. The categories of generic functions/features and specific instances thereof provided framework and the context for data collection and analysis of system related factors, which are discussed in Chapters 6 and 7. The literature review, presented in Chapter 4, provided insight into the potential non-technical factors that influence VLS usage. Secondary data collection was combined with primary data collection techniques of focused interviews, which are presented in Chapter 6 and structured surveys, which are presented in Chapter 7.

The collection of secondary and primary data, defined in section 5.5, was planned and conducted in phases where the findings of one phase was used as input to the following phase(s), as depicted in Figure 5.4.

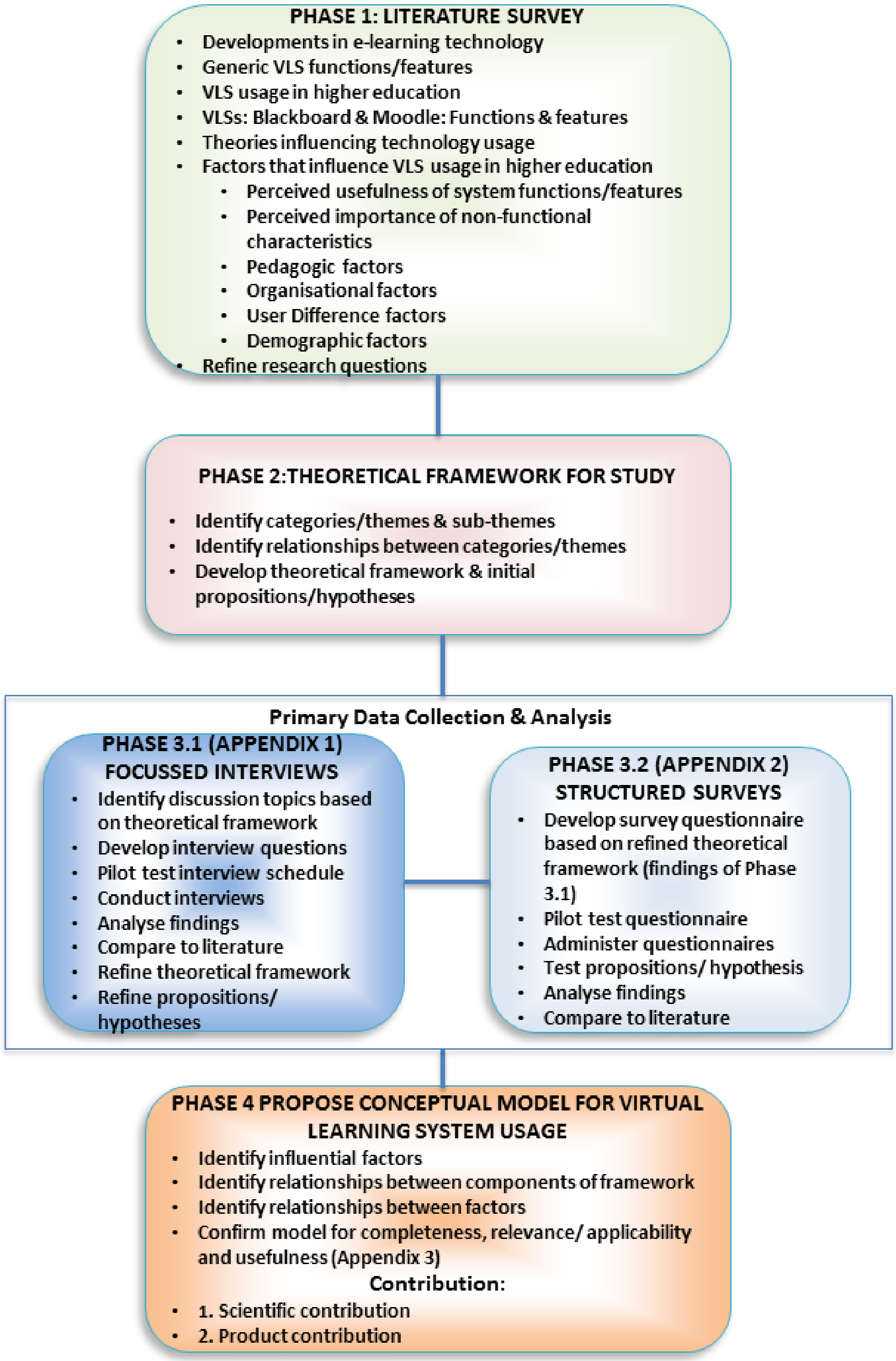

Figure 5.4: Phases of the research study

5.7.4.1 Phase 1: Literature Study

This phase involved the collection of secondary data from conducting a literature review of the various issues surrounding virtual learning system technology and usage in higher education using a variety of published sources. The issues discussed in the literature review included the main concepts, generic and specific instances of technical functions/features of virtual learning systems, socio-technical features such as pedagogic factors, organisational factors, and user difference factors as well as theories/models of e-learning systems and empirical results of other studies. Chapters 2, 3 and 4 represent the body of literature in the fields of VLS technology and factors that influence VLS usage. The literature review confirmed the research questions and provided the foundation for the initial theoretical framework for this study.

5.7.4.2 Phase 2: Initial theoretical framework and research propositions

The literature study undertaken in Phase 1 led to the creation of an initial theoretical framework described in Chapter 4, section 4.5, and depicted in Figures 4.1 and 5.5, accompanied by initial research propositions for this research, presented in Chapter 4 and repeated in this section.

The steps followed for this phase were as follows:

- Identify categories/ themes (categorical variables or factor) and sub-themes/sub-factors from literature review.
- Identify relationships between factors/ themes.
- Develop initial theoretical framework and initial propositions/hypotheses.

According to Walsham (1995), creating an initial theoretical framework allows the researcher to takes cognisance of prior knowledge, and provide a theoretical basis to inform the topics and approach of early empirical investigations.

The research was based on the following main propositions:

a) Beliefs about the usefulness of the system's functions/features influence actual system usage in higher education.
b) Beliefs about the importance attached to the system's non-functional characteristics influence actual system usage in higher education.
c) Pedagogic themes namely the characteristics of online teaching, pedagogic features, and challenges influence actual system usage in higher education.
d) Organisational themes namely e-learning support and challenges influence actual system usage in higher education.
e) User difference themes namely experience of online teaching, computer comfort level, and teaching style preference influence actual system usage in higher education.

f) Demographic themes, namely, system experience influence actual system usage in higher education.

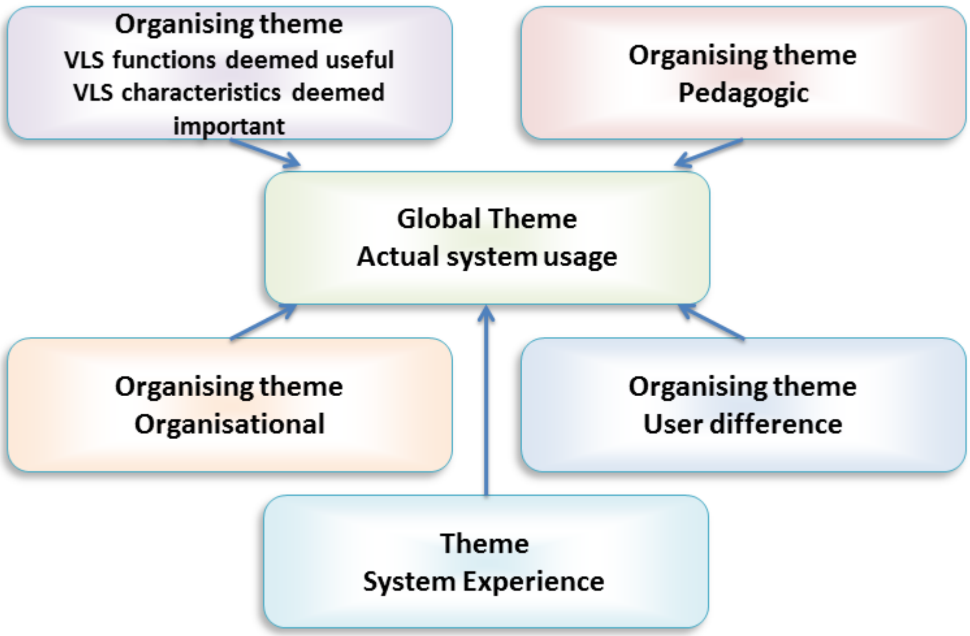

Figure 5.5: Schematic diagram of initial theoretical framework for VLS

5.7.4.3 Phase 3.1: Primary data collection and analysis: focused interviews

The steps followed for this phase were as follows:

a) Identify discussion topics based on theoretical framework

The discussion topics selected were as follows: demographic details; VLS functions and services; VLS non-functional or quality characteristics; pedagogic aspects for online teaching with a VLS; institutional e-learning capabilities/support; and e-learning challenges and limitations.

b) Develop semi-structured interview questions

The questions pertaining to each of the question categories for the interview schedule is presented in Appendix 1. The design of the interview schedule and the objective for each question category are outlined in Table 5.1:

Table 5.1: interview schedule design

Question category	Objectives of interview question categories:
Demographic details	To determine the demographic profile of the educators in the higher education institutions, namely, school/discipline; name of VLS currently/ most recently used; system experience (i.e. number of years' experience with current/most recent VLS; number of online/hybrid courses taught).
VLS functions and services	To determine what VLS functions and services were needed or regarded as useful for online teaching in the two respective institutions.
VLS non-functional or quality characteristics	To determine what VLS non-functional or quality characteristics were regarded as important for online teaching in the two respective institutions.
Pedagogic aspects	To determine what pedagogic aspects were used or deemed important for online teaching in the two respective institutions.
Institutional e-learning capabilities/support	To determine what institutional e-learning capabilities were needed for online teaching and learning in the two respective institutions.
E-learning challenges and limitations	To determine the challenges and limitations of online teaching and learning in the two respective institutions

c) Pilot test interview schedule

A pilot test of the interview schedule was conducted prior to actual data collection to check for potential problems. The pilot test was conducted with four educators from diverse disciplines at UKZN to test whether respondents understood the questions, whether different questions generated the same responses, whether interviewees had the information to answer the questions etc. The interview schedule was refined accordingly, based on the problems observed during the pilot test.

d) Conduct interviews and analyse findings for main study

In the main study, interviews were conducted with educators from the higher education institutions, i.e., DUT and UKZN. A purposive sampling technique was used to select potential participants for the focused interviews. Purposive sampling is a nonprobability sampling design defined in Chapter 1, section 1.7.2.2, that involves gathering the required information from specific targeted groups of people based on some rational basis (Sekaran & Bougie, 2010). A total of twenty six interviews were conducted for the main study. The interviews were recorded and transcribed before being imported into a computer software analysis tool NVivo (QSRInternational, n.d.). This tool was used to code qualitative data by tagging and naming selections of text within each data item (Braun & Clarke, 2006). The unit of case analysis for this study was the two residential institutions of higher education, namely, the University of KwaZulu-Natal and the Durban University of Technology. Hence, a two case study design was adopted for this study. The phenomenon being studied was the usage of virtual learning systems (VLSs) by educators in higher education. Analysis was performed using themes and codes. The thematic analysis technique for analysing qualitative data is described in section 5.6.2. To explain the phenomenon of VLS usage to integrate e-learning, a set of themes, subthemes and basic themes was identified and cluster analysis was conducted to identify correlations between the themes and VLS utilization in higher education.

e) Compare to literature

The interview findings were further analysed and compared to the literature to ascertain if they supported or refuted existing empirical studies of a similar nature.

f) Refine initial theoretical framework

Interview findings on themes and subthemes were used to refine the initial theoretical framework.

g) Refine propositions/ hypotheses

The research propositions/hypotheses were refined in accordance with the refined theoretical framework.

5.7.4.4 Phase 3.2: Primary data collection and analysis: structured surveys

Phase 3.2 involved the development of a structured survey, which tested the refined research propositions from Phase 3.1.

The steps followed for phase 3.2 were as follows:

a) Develop survey questionnaire based on refined theoretical framework (findings of Phase 3.1)

The survey questions included in the questionnaire are presented in Appendix 2. The following five point Likert scale was used in the design of many of the survey questions ranging from strongly disagree (1), disagree (2), neither agree or disagree (3), agree (4) and strongly agree (5) scale. The Likert scale used for question fifteen was as follows: not at all (0), rarely (1), sometimes (2), often (3) and usually (4). The design of the interview schedule and the objective for each question category are outlined in Table 5.2:

Table 5.2: Structured survey design

Question category	Objective
Demographic questions	To determine the demographic profile of the educators viz. school/discipline; academic rank; name of VLS used; system experience (i.e. number of years' experience with using a VLS; number of online/hybrid courses taught) in the two higher education institutions under study.
Characteristics of online teaching	To determine educators' perceptions of the characteristics of online teaching and their influence on VLS usage.
Experience of online teaching	To determine users' experiences of online teaching and their influence on VLS usage.
Pedagogic features	To determine pedagogic features needed in a VLS and their influence on VLS usage.
Nature and extent of VLE utilisation	To determine the extent and frequency of system feature usage, and usage clusters for VLSs.
Functions/features deemed useful for online teaching and learning	To determine the perceived usefulness of VLS functions/features for online teaching and their influence on VLS usage.
Importance of non-functional characteristics for a VLS	To determine the perceived importance of non-functional system characteristics for a VLS and their influence on VLS usage.
Institutional support for online teaching and e-learning	To determine the perceived importance of institutional e-learning capabilities for online teaching and learning and their influence on VLS usage.
Challenges/barriers to online teaching and learning	To determine perceived challenges and limitations to online teaching and learning and their influence on VLS usage.

b) Pilot test questionnaire

The questionnaire and completion process were pilot tested by four educators from various disciplines and a few amendments were made to clarify some items.

c) Administer questionnaires

The structured survey was administered to all members (that is, educators that were currently using or had recently used a virtual learning system) of the embedded units analysed for the two cases, that is, the instrument was administered at UKZN and DUT. Educators, who had been added to an email list because they were users of Moodle at UKZN and Blackboard at DUT, provided the participant pool for the survey. Here again, a purposive sampling technique type called judgement sampling was used which involved the selection of subjects based on expert knowledge suggested by Sekaran and Bougie (2010), in this instance, by virtue of their experiences of using a virtual learning system. They were initially contacted via email and invited to participate in the study by clicking on a link to complete a web-based questionnaire. The questionnaire took approximately thirty minutes to complete. Completion of the questionnaire was voluntary and all responses were anonymous.

d) Analyse findings

Descriptive statistics such as frequencies, charts, inferential and multivariate statistical procedures such as analysis of variance (ANOVA), t-tests, factor analysis, correlational analysis and reliability coefficient were used to analyse the quantitative data. Factor analysis helps to "reduce a number of variables to a meaningful , interpretable set of factors" (Sekaran, 2006:408). The definition of these statistical techniques was provided in section 5.6.3 and in Appendix 5.

e) Compare to literature

The survey findings were analysed in the context of the description of the two VLSs namely Blackboard and Moodle, and compared to the literature to ascertain if current survey findings support/refute existing findings for similar studies.

f) Test propositions/ hypothesis

The survey findings were used to confirm/refute the theoretical framework and research propositions and to answer the research questions outlined in Chapter 1, section 1.4.

5.7.5 Phase 4: Conceptual model development

In phase 4, a conceptual model was proposed representing the factors influencing VLS usage which is described in Chapter 8, section 8.3.

The steps followed for this phase were as follows:

a) Identify system factors component

This step entailed identifying the system factors, namely, functions/features, non-functional characteristics and challenges.

b) Identify influential factors component

This step entailed identifying the influential factors, namely, perceived usefulness, perceived importance, pedagogic factors, organisational factors, user difference factors and demographic factors.

c) Identify actual system usage component and sub-components

This step entailed identifying the actual system usage subcomponents, namely, total system usage, feature usage extent, feature usage frequency, and usage clusters.

d) Identify relationships between components of framework

The following relationship between components was examined:

- System factors component and actual system usage.
- System factors component and influential factors component.
- Influential factors component and actual system usage.

e) Identify relationships between factors

The following relationships were examined, namely:

- Perceived usefulness corresponding to system factors functions/features and actual system usage.
- Perceived importance corresponding to system factors non-functional characteristics and actual system usage.
- Pedagogic factors and actual system usage.
- Organisational factors and actual system usage.
- User difference factors and actual system usage.
- Demographic factors and actual system usage.

5.7.6 Phase 4: Model confirmation

The steps followed for this phase were as follows:

a) Develop model confirmation instrument

The design of the interview schedule for the model confirmation (refer to Appendix 3) is described in Chapter 9 and the objective for each question category is outlined in Table 5.3.

Table 5.3: Model confirmation interview schedule design

Question category	Objective
VLSUM Components	Establish the relevance of influential factors component and relationships to other VLSUM components.
Method for using the VLSUM	Establish whether the method for using VLSUM by managers/directors of e-learning or educational technology departments is practical for implementation and would promote improved VLS feature usage in higher education.
Influential factors: Perceived usefulness corresponding to *System factors*: functions/features	Establish whether *Influential factors: perceived usefulness* corresponding to *systems factors: functions/features* is an adequate representation.
Influential factors: Perceived importance corresponding to *System factors*: Non-functional characteristics	Establish whether the *Influential factors: perceived importance* corresponding to *systems factors: functions/features* is an adequate representation.
Influential factors: pedagogic factors	Establish whether the *Influential factors*: pedagogic factors is an adequate representation.
Influential factors: organisational factors	Establish whether the *Influential factors*: organisational factors is an adequate representation.
Influential factors: user difference factors	Establish whether the *Influential factors:* user difference factors is an adequate representation.
Influential factors: demographic factors	Establish whether the *Influential factors*: demographic factors is an adequate representation.
Actual system usage component	Establish whether the *actual system usage* component is an adequate representation.
Influential factors: pedagogic factors	Establish usefulness of information/ knowledge on pedagogic factors to managers/directors of e-learning or educational technology departments as well as educational technologists/instructional designers for improving *actual system usage* in higher education.
Influential factors: organisational factors	Establish usefulness of information/ knowledge on organisational factors to managers/directors of e-learning or educational technology departments for improving *actual system usage* in higher education.
Influential factors: user difference factors	Establish usefulness of information/ knowledge on user difference factors to managers/directors of e-learning or educational technology departments for improving *actual system usage* in higher education.
Influential factors: demographic factors	Establish usefulness of information/ knowledge on demographic factors to managers/directors of e-learning or educational technology departments for improving *actual system usage* in higher education.
Influential factors: user difference factors_ challenges	Establish whether information/knowledge on the following *Influential factors: user difference factors_ challenges* is useful for identifying and addressing inhibiting factors to *actual system usage*.
Influential factors: organisational factors_ challenges	Establish whether information/knowledge on the following *Influential factors: organisational factors_ challenges* is useful for identifying and addressing inhibiting factors to *actual system usage*.

b) Conduct interviews to confirm/verify model for completeness, relevance/ applicability and usefulness.

The VLSUM was evaluated using interviews. The model was evaluated using representatives of the main stakeholder groups, namely managers/ directors/ project leaders of e-learning/educational technology departments and educational technologists/instructional designers. Managers of e-learning/educational technology departments and educational technologists were approached to conduct an interview and those that responded favourably were interviewed. The confirmation process followed was to provide participants with a document that depicted the model followed by a short description of model components and relationships, and the model confirmation interview schedule prior to the interview. During the interview, the model relationships were further unpacked by using concrete examples to facilitate understanding of abstract relationships in the model. Responses to questions and additional comments made were recorded.

5.8 Triangulation

Research methods are frequently triangulated by multiple data collection methods. In this study, secondary data obtained from literature study and archival/written sources was triangulated with primary data obtained from focused interviews and structured surveys (questionnaires).

5.9 Summary

The philosophical perspectives for qualitative research, namely, positivist, interpretive, or critical were discussed. This chapter explored the different types of research methods suited to the field of information systems, and discussed the following research methods/strategies, namely, action research, case study research, ethnographic research, grounded theory and mixed methods in more detail. Common primary data collection methods were described. Both qualitative and quantitative analysis techniques were discussed. The research design and methodology used in this study covered issues of philosophy, research strategy, data collection and analysis methods, model development, model confirmation, and triangulation. An initial theoretical framework was created from the literature study to guide the data collection process and to develop initial propositions that were tested in the course of the study. Data collection was described using a combination of secondary and primary techniques. The techniques for the analysing qualitative and quantitative data were described. The research methodology section provided a detailed description of how the research design was implemented incorporating issues such generalizability, replicability, validity, and reliability as well as triangulation. Chapters 6 and 7 discuss the qualitative and quantitative findings of the case study.

CHAPTER 6: INTERVIEW FINDINGS AND QUALITATIVE DATA ANALYSIS

6.1 Introduction

The aim of this chapter is to present the findings and analyses from Phase 3.1 of this research, described in Chapter 5, section 5.7.4. The data collection and analysis presented in this chapter address the main research question 'what are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?', the research sub-questions stated in Chapter 1, section 1.4, and the six research propositions numbered a) to f) described in Chapter 4, section 4.5. These findings serve to establish the main categories/themes and associated basic themes relating to the usage of VLSs in higher education based on the initial theoretical framework, which is discussed in Chapter 4, section 4.5.

The interview data collection and analysis approach to confirm categories/themes is described in section 6.2. The profile of the interviewees is presented in section 6.3. Section 6.4 presents the results of the thematic analysis, which is segmented into seven subsections, each addressing a category/theme. The first sub-section, 6.4.1, provides an overview of the categories/themes. This is followed by subsection 6.4.2, which describes the results of category/theme *actual system usage*; subsection 6.4.3, which describes the results of category/theme *user difference theme*, subsection 6.4.4, which describes the results of category/ theme *pedagogic theme*; subsection 6.4.5, which describes the results of category/theme *system experience*; subsection 6.4.6, which describes the results of category/theme *VLS functions/features* deemed useful and *non-functional characteristics* deemed important; and subsection 6.4.7, which describes the results of category/theme *organisational theme*. Section 6.5 provides a discussion on the analysis of the qualitative study followed by the chapter summary in section 6.6.

6.2 Interview data collection and analysis approach to confirm categories and themes

This section discusses the approach used to confirm categories and themes.

6.2.1 Method

Interviews were used as the main method of data collection in this chapter to confirm categories/themes and sub-themes relating to the main research question, namely, 'what are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?' The qualitative data that forms the focus of this analysis was generated through in-depth focused semi-structured interviews (refer to Appendix 1). The interview transcripts from the two case studies constitute the empirical evidence upon which the analysis is based. The interview transcripts were imported into the NVivo analysis tool and excerpts are presented as evidence of the presence of themes and subthemes in this chapter. The strategy followed when coding in Nvivo was to identify every category from the research questions and then create a node for each category in order to gather data (text from interview transcripts) and then relate data about them. This strategy was recommended for studies that have a strong theoretical background. Coding in Nvivo is stored in nodes. A node is created for each concept to be stored. The researcher selects the text from the interview transcripts and then codes it to the appropriate node(s). As the researcher codes, the tool NVivo is adding references to the source text at the nodes, which are stored in the project database. The unit of case analysis for this study was the two residential institutions of higher education, namely, the University of KwaZulu-Natal (UKZN) and the Durban University of Technology (DUT). Hence, a two case study design was adopted for this study.

Qualitative data, in the form of text, was analysed to ascertain participants' "perceptions, feelings, knowledge and behaviour represented in the text" (Guest, MacQueen & Namey, 2012:9). Analysis was performed using themes and codes. The thematic analysis technique for analysing qualitative data was described in Chapter 5. Thematic analysis involves searching across a data set, namely, interviews or focus groups or text to identify repeated patterns of meaning (Braun & Clarke, 2006). Applied thematic analysis was the approach used for analysing the qualitative data described in section 5.6.2.1. The data collected was analysed in accordance with the study's research propositions, namely, the role of *system themes*, *pedagogic themes*, and *organisational themes*, *user difference themes* and *demographic themes* in *actual system usage* in higher education initially presented in Chapter 4, section 4.5.

6.2.2 Pilot Study

Prior to data being collected, the interview schedule was pilot tested with four educators from different disciplines at the UKZN. Two of the interviewees were from the School of Information System and Technology (IST), one from the School of Mathematics and one from the School of Economics. The interviews were recorded, transcribed and analysed and changes were made to the interview schedule.

6.2.3 Main Study

A total of twenty six interviews were conducted for the main study, ten interviews from DUT and sixteen interviews from UKZN, which were subsequently recorded, transcribed and analysed. The in-depth interviews were typically forty five minutes to one hour and fifty minutes in length. A computer software analysis tool NVivo (QSRInternational, n.d.) was used to code qualitative data by tagging and naming selections of text within each data item (Braun & Clarke, 2006).

6.3 Profile of interviewees for case studies

The residential institutions of higher education serving as the two cases for the context of this study were DUT and UKZN. Potential interviewees were identified with the assistance of responsible units for managing educational technology usage, namely, the ‘e-learning’ unit within the ‘Centre for Excellence in Learning and Teaching’ at DUT and the ‘Academic Computing’ Unit of the ‘Information and Communication Services Department’ at UKZN. These individuals were contacted via email and/or telephonically to participate in the study. The sample of educators from both institutions was representative of the population of educators using a VLS to integrate e-learning in their courses. Permission for conducting interviews was obtained prior to conducting interviews.

6.3.1 DUT

A total of ten educators were interviewed from various disciplines, namely, three from *fine arts*, one from *jewellery design*, one from *hotel and catering management*, one from *radiography*, two from *management studies* and two from *engineering*. The interviewees comprised five females and five males. Educators interviewed were teaching at both the undergraduate and postgraduate levels of study. All of the interviewees had been using the Blackboard VLS in their teaching practice for over a year. All of the interviewees had completed the ‘Pioneers Online’ training programme, which was a short certificated course. Certificated courses were run by the e-learning unit within the Centre for Excellence in Learning and Teaching (CELT) at DUT, which provided training in Blackboard together with instructional design and teaching philosophies. Some of the educators had also completed the intermediate and advanced training courses in Blackboard.

6.3.2 UKZN

A total of sixteen educators were interviewed from several disciplines, namely, one from *tele-health*, one from *IT Ed*, two from *nursing*, two from *information systems and technology*, one from *pharmacology*, one from *education*, one from *internet studies*, one from *computer science*, two from *genetics*, one from *engineering*, one from *mathematics*, one from *law*, and one from *dietetics and human nutrition*. Seven of the interviewees were males and nine were females. The level of study taught included both undergraduate and postgraduate. The minimum length of usage of the VLS Moodle by interviewees in the courses taught was a year. Some of the interviewees had attended introductory workshops on Moodle run by the Academic Computing Department while others had learnt to use the VLS through self-experimentation.

6.4 Results of the thematic analysis

Content categories/themes can be represented as organizing themes that have a grouping of one or more subthemes. The subthemes grouped under content category/theme A, for example, were identified as A1, A2, etc. Content analysis involves the use of frequency tables to depict the number of individual occurrences of themes, subthemes and associated basic themes across the two textual data sets. The frequency table summary was supported by a discussion of the relevant subthemes and associated basic themes for each content category/theme. A list of themes, subthemes and basic themes extracted from interview transcripts together with their frequencies are presented in Tables 6.1, through to 6.14. The thematic analysis is driven by the main research question 'What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?'

6.4.1 Overview of content categories/themes

Tables 6.1 and 6.2 provide a summary of the content categories or themes for DUT and UKZN together with a frequency count illustrating the prevalence of the themes coded/tagged from all the interview transcripts separated by case, covering all the interview questions in the interview schedule (refer to Appendix 1). Tables 6.1 and 6.2 relate to the main research question listed in Chapter 1, section 1.4. The sources column represents the number of participants that made reference to the coded theme, and the references column represents a count of the individual occurrences relating to the coded theme across each data set. These themes collectively capture important aspects/ elements that play a role in VLS usage in higher education. Each content category or theme is described in terms of what is of interest about them and why, as well as how it fits into the overall context in relation to the main research question. In addition, each theme was described in terms of its subthemes and basic themes supported by relevant data extracts. The relationship among the various themes is also discussed.

Table 6.1: DUT content categories or themes

	Themes	Sources	References
A.	Actual system usage	10	60
B.	User difference	10	51
C.	Pedagogic	10	148
D.	System experience (length of VLS usage in years and number of distinct online/hybrid courses taught)	10	10
E.	Virtual learning system functions and non-functional characteristics deemed useful	10	417
F.	Organisational	10	99

The DUT count of individual occurrences of key themes shown in the references column in ranked order from highest to lowest was: VLS functions deemed useful; pedagogic theme; organisational theme; actual system usage; user difference theme; and system experience.

Table 6.2: UKZN content categories or themes

	Themes	Sources	References
A.	Actual system usage	16	148
B.	User difference	16	64
C.	Pedagogic	16	221
D.	System experience (length of VLS usage in years and number of distinct online/hybrid courses taught)	16	16
E.	Virtual learning system functions and non-functional characteristics deemed useful	16	609
F.	Organisational	16	121

The UKZN count of individual occurrences of key themes in ranked order from highest to lowest was: VLS functions deemed useful; pedagogic theme; actual system usage; organisational theme; user difference themes; and system experience.

The two highest individual occurrences of key themes for DUT and UKZN were VLS functions deemed useful and pedagogic theme. The two lowest individual occurrences of key themes for DUT and UKZN were user difference theme and system experience. The count of individual occurrences of the theme actual system usage is not high probably due to the fact that the interview question eliciting responses of usage was combined with functions deemed to be useful. The text had to be closely analysed to separate what was actually used from that which was deemed to be useful. However, the data suggests that there is a close link between the functions deemed to be useful and those actually used. Some of the reasons for not actually using tools that were perceived as useful can be linked to other themes and/or the subtheme challenges described in sections 6.4.3, 6.4.4, 6.4.6 and 6.4.7. The low count of individual occurrences of the theme 'system experience' is expected as participants were asked two factual questions on the length of usage and number of courses taught and individual responses to both these questions were coded together as an individual occurrence. Hence, the number of sources is equal to the number of references for this theme. The lower than expected count of individual occurrences for the user difference theme was also expected as there was no specific question in the interview schedule that addressed the user difference theme. The user difference theme emerged from responses to interview questions.

6.4.2 Content category/theme A: actual system usage

Content category or theme A represents participants' actual usage of the tools and services of a virtual learning system (VLS) for online/blended teaching and learning. This theme represents the global theme aimed at understanding the phenomenon of VLS usage behaviour in residential institutions of higher education. Tables 6.3 and 6.4 partially address research sub-question 1 listed in Chapter 1, section 1.4 in so far as it provides insight into system feature usage extent. All references in the interview transcripts separated by case that made a reference to the current usage of the VLS were coded as 'actual system usage'.

6.4.2.1 DUT Blackboard actual system usage

Table 6.3 provides a summary of the Blackboard's tools and associated functions/features currently used by educators interviewed at DUT, extracted from the interview transcript excerpts stored at the coded theme 'actual system usage'. A detailed discussion of relevant tools, function/features and properties of the Blackboard VLS was presented in Chapter 3, sections 3.2.

Table 6.3: DUT Blackboard actual system usage

Blackboard tools	Functions/Features usage
Communication	Blog discussion; Threaded discussion forums; Announcements; E-mail; Course calendar; Files exchanges.
Student Productivity and Involvement	Journal entries; Group work; Student profile; Self-tests; Student journal.
Administration	Grouping of students; Selective release via hiding of documents; Selecting course tools; Organising content; Copying of course resources; Saving students' submissions as artefacts; Managing assessments and submissions.
Assessment	Creating and administering online quizzes; Creating and administering self-tests; Submission of students assignments; Online marking and grading; Assessment feedback; Grade book; Grading forms; Peer evaluation; Grading student posts; Exporting grade book to spreadsheet; Statistics for test questions; Conducting surveys.
Student Progress Tracking	Student progress; Student submission; Student activities.
Content	Content delivery; Creation of learning objects, quizzes, websites, glossary; Storing multi-media content in media library; Using web links; Learning module tool.

Additional or alternative tools used by educators at DUT*:*

- Skype (Skype, n.d.).
- Face book (Facebook, n.d.).
- Flickr (Flickr, n.d.), which is an online photo management and sharing application for visual content.
- Microsoft Excel spread sheets for recording and analysing assessment marks, as well as calculation of class and final marks (Office, n.d.).
- An online bibliographic management system.
- The use of authoring tools like Dreamweaver (Adobe, n.d) to create dynamic web pages for courses.
- Microsoft Word for making comments on essay type assignment submitted by students (Office, n.d.).
- Plagiarism detection tool.
- Creations of public blogs where students can describe their artefacts as part of their training as designers. A section of the blog is a portfolio and the other section is a journal. Lecturers can use the general posting section to comment on the design.

6.4.2.2 UKZN Moodle actual system usage

Table 6.4 provides a summary of the Moodle tools and associated functions/features currently used by the educators interviewed at UKZN extracted from the interview transcripts excerpts stored at the coded theme 'actual system usage'. A detailed description of the relevant tools, functions/features and properties of Moodle is presented in Chapter 3, sections 3.2.

Table 6.4: UKZN Moodle actual system usage

Moodle tools	Functions/Features usage
Communication	Blogs; Threaded discussion forums; Wikis; Chats; Announcements/ notices; E-mail; Course calendar; File uploading and sharing.
Student Productivity and Involvement	Student reflective Journal; Group work; Student profile.
Administration	Grouping of students; Selective release of documents; Hiding courses/documents; Setting up and organising courses; Student evaluation surveys.
Assessment	Quizzes; Importing questions; Tests; Assignments; Online marking; Grade book; Peer review workshops; Grading student online participation; Exporting grade book.
Student Progress Tracking	Student progress; Student submission; Student usage statistics and activity reports.
Content	Content delivery; Creating a resource library of materials; Creating course glossary, lessons; Linking to websites/ internet resources; Multi-media.

Additional or alternative tools used:

- Third party tool called authorPoint (AuthorGEN, n.d.), for multimedia e-learning presentations.
- Dimdim open source video conferencing tool (SourceForge, n.d.), for distance learning programmes.
- Elluminate web conferencing program (Elluminate, n.d.), which has a whiteboard tool to support uploading of presentations on the whiteboard for a class.
- Microsoft Excel spreadsheet (Office, n.d.).
- Social networking software like Face book (Facebook, n.d.) and Edmodo (Edmodo, n.d.), which is a social learning network.
- Mendeley a referencing and bibliographic tool (Mendeley, n.d.), for postgraduate research based programmes.
- Turnitin plagiarism checker (Turnitin, n.d.).
- JSTOR, which allowed students to search online repositories for academic content (JSTOR, n.d.);
- ZOTERO, which can be used by students and researchers to collect, organize, cite, and share research sources (Zotero, n.d.).
- Second Life was another application used, which is a three dimensional environment suitable for pure distance courses that allows students who are geographically dispersed to socialize, connect and create using free voice and text chat (SecondLife, n.d.).

6.4.2.3 Analysis of actual system usage at DUT and UKZN

Commonly used communication tools across institutions were discussion forums, e-mail, calendars, and announcements/notice board/news forum and file exchanges.

The discussion forums were used for a variety of purposes, namely, for general inquiries, for topic related discussions, for commenting on other students posts, for providing an opportunity for all students to contribute to discussions, as well as grading student participation in online discussions. This result confirmed the findings of a survey of instructors conducted by Brannon and Essex (2001) on the use of synchronous and asynchronous tools in distance education, which reported asynchronous communication to be more helpful for in-depth, more thoughtful discussion, allowing all students to respond to a topic.

The web 2.0 tools were used less often, with blogging being used more than wikis. Public blogs were preferred over the blogging discussion tool within Blackboard in DUT to foster a community of learning. According to Hurlburt (2008), blogs contained within VLS environments offer very little in the way of personalization of the virtual learning space when compared to blog environments such as WordPress or Blogger. Hurlburt (2008) attributes this lack to VLS designs based on nineteenth and twentieth century pedagogical models that fail to recognize the potential in social constructivist models for learning. There is no built-in wiki tool within Blackboard, which explains the lack of usage. Users can link to an external wiki but they need a password, which was reported to be a deterrent to usage.

The chat facility was reported to be used for pure distance postgraduate programmes at UKZN where there was no face-to-face contact. A survey of instructors conducted by Brannon and Essex (2001), reported that community building was one of the reasons given for using the synchronous chat tool. Interviewees at DUT did not report using the chat facility. For some part-time pure distance programmes, it was reported to be even more difficult to set up a convenient time for all to engage synchronously using the chat facility.

There was similarity in the usage patterns of communication, course administration, course content, course assessment, student involvement and productivity, and student tracking tools for both DUT and UKZN. Common uses of a VLS were content delivery; communication; administration; online quizzes; and online assignment submissions. There was less emphasis placed on the use of a VLS for student tracking and student productivity and involvement. This result confirmed the findings of the study by Oliver and Moore (2008), where content presentation tools were used to post static content and syllabi; more complicated tools such as the grade book and interactive tools such as discussion boards were being adopted more slowly; and communication tools were used typically one way from instructor to student.
In addition, this result confirmed the finding of Beck (2005) that virtual learning systems were used for a "delivery" teaching style, as it facilitated easy distribution of lecture material and convenient submission of students' assignments.

Some of the patterns of actual system usage reported by educators were as follows:

- Some interviewees at UKZN reported that their students were reluctant to engage in online forum discussions and that online communication was typically one way from lecturer to students. This result confirmed the finding reported by Brown and Peterson (2008) that the mode of VLS communication was broadcast in nature, from the faculty member to the student.
- Self-tests in the form of quizzes seemed to be favoured over formal online tests due to the logistics involved in setting up the tests and the physical facilities needed.
- The use of journals was reported to be appropriate and, hence, used for some disciplines while not for others.
- Peer reviews were used mostly for postgraduate programmes.
- The grade book was not widely used as educators at both institutions were comfortable using the spreadsheet for capturing and analysing assessment marks. Those that did use the grade book still exported to a spreadsheet for performing statistical analysis.

- Online submission of assignments was a commonly used facility across both institutions. While online submission of assignments via a VLS was used at DUT and UKZN, some educators reported that their students preferred handing in hard copy assignments or attaching assignments to e-mails rather than using the online submission facility of a VLS.
- Moodle has a workshop facility as described in Chapter 3, Table 3.1 for performing peer reviews of assignments, which was only used by a few educators as most educators did not know about the existence of this tool and its purpose apart from knowing how to use the tool.
- Blackboard has a learning module while Moodle has a facility to create lessons as described in Chapter 3, Table 3.1, both of which were used by a select few individuals.
- Online marking was performed by downloading assignments, marking them using the comments facility in Word or PDF, uploading marked assignments onto the system and capturing the individual marks in the grade book or spreadsheet.
- Some of the educators interviewed at both DUT and UKZN reported that they had not used synchronous tools such as chats and videoconferencing tools nor had they conducted online tests. This result confirmed the observation made by Oliver and Moore (2008) that some instructors were not using instructional functions such as conducting quizzes or collecting and returning assignments online, suggesting that those that supplement their courses with a VLS employ tools differently from those who teach fully online.
- Staff at UKZN welcomed the integration of Turnitin, a checking plagiarism tool into Moodle, and a few educators stated that they use the Turnitin online marking facility.

The analysis of system (VLS) usage at both DUT and UKZN was varied in terms of scope and frequency of usage. Asynchronous tools were frequently used since both the higher education institutions were residence-based. All educators at both institutions had not embraced the formal online testing because of institutional resource limitations. However there was a growing trend amongst educators to set and administer quizzes via a VLS. There was selective use of the learning module/lessons; peer reviews; online marking; grade book; journals; blogs, wikis and synchronous tools. Online communication was in the main conducted in broadcast mode with few exceptions where online discussion was encouraged. Some tools like the whiteboard, real time chats and video conferencing were not used as the educators had no real need to use them in residence-based institutions.. Some educators at both institutions expressed the view that while VLSs like Blackboard or Moodle have many good functions/features, they do not have everything that lecturers or students need. One view expressed is that VLSs are on the way out and would be replaced by learning portals where the student decides the tools needed to facilitate and manage his/her own learning.

6.4.3 Content category/theme B: User difference

This content category presents user difference, which comprise the following subthemes:

- Computer comfort level and experience.
- Teaching style preferences.
- Experience of online teaching.
- Challenges.

This theme is important as it represents individuals' perceptions, feelings, and knowledge and its relation to VLS usage behaviour in residential institutions of higher education. The user difference theme was further segmented into a number of subthemes and addresses research sub-question 5, listed in Chapter 1, section 1.4. This theme is depicted in Tables 6.5 and 6.6 together with associated frequency counts illustrating prevalence of the subthemes coded/tagged from all the interview transcripts separated by case, covering 'demographic' and 'e-learning challenges' questions (refer to Appendix 1). These subthemes are identified and described in sub-sections 6.4.3.1 and 6.4.3.2. The relatively low count of individual occurrence of subthemes does not infer that these subthemes are less important. Rather these low counts can firstly be attributed to the fact that there were no specific questions eliciting user characteristics and user challenges other than 'general' and 'e-learning challenges' questions. Secondly, the coding technique used for coding computer comfort level and experience was to tag each respondent's answer regarding their computer experience, which resulted in the number of sources being equal to the number of references.

6.4.3.1 DUT user difference theme

The count of individual occurrences of the subthemes within the user difference category/theme for DUT is summarized in Table 6.5. The results/ outcomes for the organizing theme and subthemes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.5: DUT user difference theme

Organising Theme	Subthemes	Sources	References
User difference		**10**	**51**
	Experience of online teaching	6	14
	Computer comfort level and experience	10	10
	Teaching style preference	4	8
	User challenges	9	19

a) Experience of online teaching

The experience of online teaching subtheme covered the following basic themes:

- **Time and effort involved in online classroom**

  Experience of online teachings demonstrated both an increase as well as a decrease in the time and effort expended for online teaching. Data extracts that demonstrate prevalence of this basic theme were: 'this takes a lot of time, and a lot of work'; 'I think a lot of lecturers shy away from creating quizzes because it takes hours of work'; 'I had to do a lot of work just to click on thirty five assignments, download them onto my computer in a folder, mark them on my computer and put each one up again'; 'time saving if it's all online, it can save you time'; 'automatic marking reduces workload'.

- **Effectiveness of online course delivery**

  Experience of online teaching confirms that online delivery via the Blackboard VLS is effective. This is supported by the following data extracts: 'The e-learning classroom was the heart of the work integrated learning process. Without the online classroom, it wouldn't have worked. The classroom functioned as a place where everyone could go in and gather information or bring in the information they had gathered and talk to each other'; 'the discussion tool did a really good job in that you don't really have that wall first of all, and you have everybody talking to each other and again what I really like is you got evidence. You can read everything later if you are really interested in knowing how much the students know'; 'creating threads to discuss assignments/ readings/ lectures etc.'

- **Online classroom communication**

  Experience of online teaching, namely, the convenience of online communication was demonstrated by the following data extracts: 'I had the ability to interact with the students through the discussions and mail'; 'what I also love was the e-mail that is in the software, which I used to communicate new deadlines or new arrangements or agreements'.

b) Computer comfort level and experience

All the educators interviewed reported that they were familiar with, and comfortable using office applications, and were also competent with other specialised application software. Data extracts supporting the comfort level and experience with computer applications were: 'Familiar with programs like Word, Excel, PowerPoint. Use the Adobe Package End Design, Illustrator, and Photoshop'; 'I have a good understanding of Microsoft Word packages i.e. Word, Excel, PowerPoint, FrontPage, Blackboard, e-mail and design tools such as PageMaker, PhotoShop, Inkscape and Image Ready'; 'use computer-aided design program, called Ceniro'; 'use software for the Hospitality and Catering industries'.

c) Teaching style preference

Educators reported a preference for a blended teaching approach. This preference for a blended approach is borne by some of the following data extracts:' Cannot get rid of face-to-face as people like to relate to each other'; 'person-to-person contact cannot be replaced'.

d) User challenges or barriers

The user challenges subtheme raised by interviewees at DUT with regards to online teaching in higher education was further segmented into basic themes as follows:

- **Lack of time**

  Interviewees reported that the lack of time was a key barrier to VLS usage. Data extracts confirming this finding were as follows: 'time was needed to develop online assessments'; 'a lot of time investment initially'; 'Educators not willing to go there or to give off their time and effort'; 'Faculty can assist. We do not have the time to learn it on our own'.

- **Changing mind-set to online teaching**

  Interviewees reported that changing the mind-set of educators to online teaching and learning was a barrier to the acceptance and usage of VLSs. The following data extracts confirm this finding: 'people struggle to move out of their comfort zone'; 'e-learning is a mind shift you got to re-skill yourself'; 'lecturers do not like to change too much'; 'a lot of reluctance, lethargy'; 'educators reluctance to go into e-learning'; 'I think it is a lack of knowledge, a lack of interest'.

- **Lack of confidence**

  Interviewees reported that some staff lacked confidence to use technology in teaching and learning. Data extracts that demonstrate prevalence of this basic theme were: 'That's the hard part having the confidence to try something like an online discussion when you are not sure whether it's going to work or whether it's not going to work'; 'staff are nervous to put themselves out there, they are not sure whether it's going to work or not.'

6.4.3.2 UKZN user difference theme

The count of individual occurrences of subthemes identified within the user difference category/theme for UKZN is summarized in Table 6.6. The outcomes/results for the organizing theme and subthemes are described below. Data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.6: UKZN user difference theme

Organising theme	Subthemes	Sources	References
User difference		16	64
	Experience of online teaching	9	14
	Computer comfort level and experience	16	17
	Teaching style preference	3	3
	User challenges	11	30

a) Experience of online teaching

The users' experience subtheme covered the following basic themes:

- **Effectiveness of online course delivery**

Experience of online teaching reported was that online course delivery via the Moodle VLS was effective. Some of the data extracts that support this finding were: 'you can do so much more in terms of keeping their interest; deeper engagement; keeping the interaction alive. More satisfied, effective and productive'; 'I just taught my course in HTML online'.

- **Time and effort involved in online classroom**

Experience of online teaching confirmed that there was both an increase as well as decrease in the time and effort involved in the online classroom. Some of the data extracts that support the finding of reduced time and effort were: 'you do not realise how easy the system makes your job unless you do it**.** Admin load is decreased by so much; you don't have to worry about keeping hard copies of students assignments'; from a management point of view it saves a lot of time'. Data extracts that support the finding of more time and effort were: 'By the time i finished the marking i had a folder of things and then I had to type in my marking scheme in the comments sections for each one of them'; 'our online assessments take a long time to set up'; 'I find it (online discussions) quite cumbersome, and a lot of writing and reading, it's time consuming'; 'Entering items into glossary is work intensive, cumbersome and frustrating'.

- **Online classroom communication**

Experience of online teaching with regards to online classroom communication was generally positive. Some of the data extracts that support this finding for online classroom communication were: 'the strength of the online environment you have got twenty four, seven access so you can post a note, the note comes to my e-mail. I answer student queries and engage with them when I am on holiday ,so that is amazing as I wouldn't be able to do that if I didn't have an online environment'; 'What's nice if I am Norway and the class asks me a question, I can answer them because of e-learning.

b) Computer comfort level and experience

The educators interviewed at UKZN were computer literate and reported that they were comfortable using computer applications. Some of the data extracts that support this finding were: ‘expert user of Office packages; technical computing background, software development experience’; ‘I built websites’; ‘comfortable with all the standard things like Excel and Word, presentations, paint’; ‘I have some knowledge of programming and databases’; and ‘I took a web design course’.

c) Teaching style or preference

Many educators showed a preference for a blended approach. The comments supporting this approach were: ‘Complement e-learning with face-to-face’; ‘Face-to-face learning and e-learning should complement one another’; ‘Blended form of teaching and learning is preferable’.

d) User challenges/barriers

The user challenges subtheme covered the following basic themes:

- **Lack of time**

  Interviewees reported that a lack of time was a key barrier that influenced VLS usage behaviour. Data extracts confirming this finding were: ‘You need time to set up glossary entries and lesson activities, which is time away from research’; ‘they don’t do that, not because they can’t, or it won’t work for them, but because they don’t have the time’; ‘you have to have the time to set it (lesson activities) up’; ‘lecturers do not have the time to learn how to use the various tools by themselves’.

- **Changing mind-set to online teaching and learning**

  Interviewees reported that changing the educator’s mind-set to online teaching was another key barrier to widespread acceptance and usage of VLSs. Some of the following data extracts confirm this finding: ‘has to be a mind shift’; people do not want to put the effort in; a lot of reluctance, lethargy, people don’t want to change’; ‘a lot of apathy and people don’t want to take it up and they think it is more difficult than it is; there is a lot of reluctance’; ‘changing the way you lecture with technology’; ‘because it is an open source system people have to go and learn by themselves and very few people want to do that’; ‘people struggle to move out of their comfort zone’; ‘they are resistant to change’; ‘the mind-set specifically of the lecturers is very old fashioned so it’s hard to get them to get used to the new system’; ‘lecturers are used to doing things one way. They struggle to move out of their comfort zones’. ‘e-learning tools are available that are not difficult to use and implement in a university setting but it is the lecturers or the students that are reluctant to use it’; ‘People are not trained in teaching philosophies (lack of pedagogic awareness)’; ‘the way technology is used is limited by the imagination of the people using them’.

- **Lack of confidence**

  Interviewees reported that lack of confidence was another barrier to widespread acceptance and usage of VLSs. Some of the data extracts confirming this finding were: 'staff members have just as much technology phobia as the students'; 'there's this huge other thing that I have to learn'; 'they see embracing e-learning as a lot of effort'.

6.4.3.3 Analysis of user difference theme for DUT and UKZN

The same key subthemes and basic themes for the user difference category or theme were reported by interviewees at DUT and UKZN. These findings supported the findings of (Hubona et al., 1996:173) discussed in Chapter 4, section 4.3.3, who suggested the importance of 'a fit between individual characteristics and the technology'. Both groups of educators reported that they were computer literate and comfortable using computer applications. Al-Busaidi and Al-Shihi (2010) reported a significant effect of computer self-efficacy on instructors' acceptance of an e-learning system. Both groups of educators reported a preference for a blended teaching style comprising face-to-face and online teaching. The role of the instructor's teaching style has been highlighted in studies reported by Al-Busaidi and Al-Shihi (2010) who found that instructors with interactive teaching styles are critical to the learning outcome. The user challenges were very similar despite the fact that DUT had formal training programmes for using Blackboard to integrate e-learning whilst UKZN had not. The experience of online teaching of both groups demonstrated positive findings for effectiveness of online delivery and online classroom communication, and both positive and negative findings for the time and effort involved in the online classroom. Educators' experience of online teaching with regards to effectiveness, supported the finding of Song et al. (2004); ease of communication experience supported the finding of Al-Busaidi and Al-Shihi (2010); effort involved supported the finding of McGill et al. (2008).

6.4.4 Content category/theme C: Pedagogic

Content category or theme C represents the pedagogic theme and, as such, represents the socio-technical aspects of the study. The pedagogic theme was further segmented into a number of subthemes, namely, pedagogic features, characteristics of the online classroom, and challenges and addresses research sub-question 3 listed in Chapter 1, section 1.4. This theme and subthemes are depicted in Tables 6.7 and 6.8 together with associated frequency counts illustrating prevalence of the subthemes coded/tagged from all the interview transcripts separated by case, covering the 'pedagogic aspects for online teaching with a VLS' interview question category (refer to Appendix 1). It is important to understand the characteristics of online teaching and pedagogic features and its relation to VLS usage behaviour in residential institutions of higher education. Pedagogic features are related to the domain tasks of teaching and learning. The characteristics of online teaching represent the benefits and opportunities afforded by online classroom or online teaching and learning. The subthemes were further segmented into a number of basic themes, which are identified and described in sub-sections 6.4.4.1 and 6.4.4.2.

6.4.4.1 DUT Pedagogic theme

The count of individual occurrences of the subthemes and basic themes within the pedagogic category/theme for DUT is summarized in Table 6.7. The results/outcomes for each of the subthemes and associated basic themes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.7: DUT Pedagogic theme

Organising theme	Subthemes and Basic Themes	Sources	References
Pedagogic		10	148
	Characteristics of online teaching	5	13
	Pedagogic features	10	135
	Pedagogic approaches underpinned by learning theories	8	10
	Learning strategies	10	65
	Instructional design strategies	8	16
	Pedagogic Challenges	10	44

a) Characteristics of online teaching with a VLS

Educators' perceptions of the 'characteristics of the online classroom' subtheme offered by the Blackboard system at DUT were segmented into the following basic themes:

- **Flexibility**

  Data extracts in support of this characteristic were 'students could work at different paces'; 'students can access course material asynchronously'; 'e learning is good in more ways because the student can spend as much time as he needs to pick up concepts, to pick up a skill'.

- **Course management**

  Data extracts supporting this characteristic were: 'For me what actually works the best is the administration side of the software';' To use the management part of the system that is incorporated'; 'I use it as a management tool to manage my course or to manage students' contributions.'; 'The ability to turn the assignment back for further work'; 'mainly as a way of managing and to make sure that work is handed in'.

- **Learner-centeredness**

Data extracts supporting this characteristic were: ‘more student-focused approach to learning’; ‘supporting active learning engagement’.

- **Collaborative learning**

Data extracts supporting this characteristic were: ‘to learn from others so the threaded discussion forum is important’; ‘I think the new way of teaching and learning is that students learn more from each other’ ; ‘they are building knowledge but through one another’.

- **Tracking of students’ progress**

Data extracts supporting this characteristic were: ‘I think the system really helps to monitor all students’; ‘It’s easy to track students’ contributions and in that way Backboard is a brilliant system’; ‘I think the reflective journal was very good for reflection on their practice’.

- **More teaching and instructional strategies**

Data extracts supporting this characteristic were: ‘Depends really on what you are teaching and what you want your students to learn’; ‘learning terminology is very different from critical thinking learning’; ‘I feel that the tool didn’t restrict me in my philosophies of teaching. I found I could use the tool to accommodate my different approaches’; ‘more assessments could be done with an online teaching and learning environment’; ‘VLS can be used for revision purposes’.

- **Communication and eliciting feedback**

Data extracts supporting this characteristic were: ‘I love the e-mail that is in the software. I used it to communicate new deadlines or new arrangements or agreements or whatever, but I now also have a record of that’; ‘Students don’t mind telling you what they think. In a way they do give you feedback by telling you what’s working or not working, but at some stage we have to formalise it’.

b) Pedagogic features

The pedagogic features subtheme covered the following basic themes:

- **Pedagogic approaches underpinned by learning theories**

Educators at DUT reported using a combination of pedagogic approaches based on a number of learning theories. Data extracts pertaining to pedagogic approaches deemed useful were: ‘use a combination of learning theories, social constructivist approach, communities of learning, and constructivism are useful’; ‘Instructivist approach (lecture mode)’; ‘Constructionist – assisting and facilitating the discussions’; ‘Using the online classroom so that learners have an opportunity to create their own learning environment (threads, blogs etc.)'; 'Creating a supportive and friendly learning environment –more student-focused approach to learning; supporting active learning engagement';' I like to basically let the students to be able to go onto what I said and pull it apart and give their own interpretation and their point of view'; 'I think the communities of learning would be pretty useful'; Constructivist but I don't throw behaviourism out of the window, it depends really on what you are teaching and what you want your students to learn'; 'social constructivist approach you want them to be responsible for their own learning'; 'learner-centred environment'. An educator reported that the 'tool does not restrict any teaching philosophies by stating that while the social networking tools in Blackboard are too structured, educators can use existing social network applications. Another educator strongly supports community of learning theory and uses public blogging tool to achieve this. The reasons given for the use of public blogging tools outside the Blackboard learning environment were that it allows the educator to 'create a community of learning, it is more flexible, offers tracking capabilities, and incorporates portfolios and journals'.

- **Learning strategies**

A wide range of learning strategies was deemed useful by educators, and confirms their inclusion as instructional functions of a VLS. Extracts supporting the usefulness of learning strategies were: 'peer review of assignments at higher levels'; 'quizzes and other forms of self-assessment'; 'formative assessments'; 'assessment feedback'; 'using professional language when blogging on a particular topic and commenting on other students' blogs'; 'threaded discussion for collaborative learning'; 'podcasts'; 'learning portfolio'; 'links to YouTube videos '; 'sharing material'; ' students' journal entries reflecting on their own learning progress';' problem solving'; 'information seeking behaviour by linking to various resources' ;'resource based learning'; 'visually document work and share with others'; 'learning activities that encourage critical thinking' ; 'authentic learning activities'; 'active learning techniques'.

- **Instructional design strategies**

Diverse instructional design strategies were deployed by educators at DUT, which confirm the need for these instructional functions to be incorporated into a VLS. Extracts confirming the use of instructional strategies were: 'design different classrooms to cater for groups of students with different levels of computer skills'; 'teaching is all structured and guided as students are not independent learners at first level'; 'award marks for posting and commenting on other students posts'; 'design a sequence of learning activities'; 'set quizzes before assignments'; ' use a simple grading scale for blog discussions'; 'hyperlink the objectives to assessments'; 'integrate courses with the internet'; 'comment on artefact type of work'; 'create learning objects that are flexible and reusable'; 'link assignments (assessments) to learning content'; 'comment on journal entries; use peer assessment or peer comments; use online forums for queries and explanations'; 'link lecture to media library'; 'be a facilitator of the learning'; 'cater for diverse learning styles by using audio, podcasts and visual material'; 'shift from individualism to collaboration'; 'ability to translate instructions to different languages'; 'post links to useful websites; 'make resource material, lecture notes, all course related material tests etc. available online'; 'create learning modules with learning materials, self-tests and assignments'.

c) Pedagogic challenges

The pedagogic challenges subtheme reported by educators interviewed at DUT was as follows:

- Distance mediation (social, emotional and personal loss) challenges confirmed by data extracts such as: 'Communication is difficult because you don't have the body language you don't have the voices'; 'In a classroom you can see if someone is engaging or not, with but with online it's hard to tell'; 'I think reading into people responses', 'the visual cues, which prompt you to explain further '; 'personal interaction, you can't really duplicate that'; 'we are social beings, it is important to keep personal contact'; 'I am not writing to one person I am writing to many people'.
- Online discussion forums challenges, namely, poor student uptake of online discussion forum; complexity of managing online threaded discussions in large classes, and lack of access as the University's computer laboratory facilities are limited and every student does not own a laptop or home PC with internet connectivity, which prevents them from contributing anytime, anywhere.
- Student's prior learning, namely, varying levels of computer literacy, a lack of general knowledge, lack of information literacy, lack of independent learning, and poor English language proficiency.
- Discipline specific issues, namely, how to incorporate e-learning into a practical and studio-based learning environment. Data extracts confirming discipline specific issues were: 'For jewellery design work it takes too long to upload'; 'drawing online is cumbersome'.

6.4.4.2 UKZN Pedagogic theme

The count of individual occurrences of the subthemes and basic themes within the pedagogic theme of the Moodle system for UKZN is summarized in Table 6.8. The results/ outcomes for each of the subthemes and associated basic themes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.8: UKZN Pedagogic theme

Organising theme	Subthemes and Basic Themes	Sources	References
Pedagogic theme		16	221
	Characteristics of online teaching	11	21
	Pedagogic features	16	200
	Pedagogic approaches (underpinned by learning theories)	13	26
	Learning strategies	16	66
	Instructional design strategies	13	39
	Pedagogic Challenges	16	69

a) Characteristics of online teaching

Educators' perceptions of the characteristics of the VLE component offered by Moodle at UKZN were:

- **Flexibility**

  Extracts supporting this characteristic were: 'wireless access protocol (WAP) enabled cell phone for access'; 'you can mark anywhere in the world you do not have to lug pieces of paper around to mark; you can be in a conference somewhere you can go into the system bring up their assignments'; 'mark them and upload marks'; 'What's nice if I am Norway and the class asks me a question, I can answer them because of e-learning'; 'I was sitting on top of a rock in Drakensburg and I was answering student queries and engaging them so that is amazing as I wouldn't be able to do that if I didn't have an online environment'; 'in e-learning students can focus more on understanding course content than they can do in class'.

- **Learner centred**

  Extracts supporting this characteristic were 'online learning, which forces them to think and to express themselves'; 'student involvement lot of space for discussion; if you can draw them into discussion; whether you do that by putting a video, putting a blog, some sort of post by there, giving them the space and encouraging them to engage with it'; 'It's about students being able to create their own understanding of where they work, interpret and being able to build on that. They should also be able to apply what they are learning to what they do. Also build on their experience to learn further'.

- **Collaborative learning**

  Extracts supporting this characteristic were 'Sometimes they work in groups, grouped with people from the same place and with people from other towns and other countries (cross-cultural)'; 'it might be useful if they can help each other'; 'it would be wikis where you collaboratively build stuff'; 'Peer collaboration I think is most powerful and that could be really simple like how forums work'.

- **Tracking of students' progress**

Extracts supporting this characteristic were: 'Tracking students' grades are useful they are able to see all their grades and how they are doing'; 'automatically tracks students participation'; 'track students' progress in terms of their quizzes or assignments or things like that'.

- **Better course management**

Extracts supporting this characteristic were: 'the actual management part, the fact I can upload or they can upload their assignments or I can publish their marks. That's makes it easier'; 'It allows you to organise your courses'; 'the fact that it functions as a course management system as well as a virtual learning environment'; 'Posting notes on a VLS has a management benefit'.

- **More teaching and learning styles**

Extract supporting this characteristic was: 'they all very useful and that's the whole point online learning allows for more variation if you use it well. If you have a forum and you have a movie and you have a lesson you can put so much stuff on; so a combination of things can cater for different styles'.

- **Communication/ elicit student feedback**

Extracts supporting this characteristic were 'my most important things would be things that support communication that would be all sorts of blogging, micro blogging '; 'we conducted our session via live chat and kept a record of our session;' 'communication and the ability to bring people together where they learn and share knowledge'; 'engage students'; 'midway through the course to ascertain 'What was useful about the course? What do you want more from the course?'; 'evaluating the quality of online learning'; 'students are less inhibited and more frank in online discussions than they are in face-to-face discussion'.

b) Pedagogic features

The pedagogic features subtheme covered the following basic themes:

- **Pedagogic approaches underpinned by learning theories**

Educators at UKZN also reported a combination of pedagogic approaches based on a number of learning theories that they found useful for their practice as educationists. Data extracts confirming pedagogic approaches deemed useful were: 'constructivism- students had to create their own Moodle site'; 'instructivist second year is more content based'; 'what we tend to follow is an instructivist approach, certain aspects of what we teach has to be instructivist';' create a community of learners including things like discussion forums, chat rooms, supporting collaborative work through a wiki or

Wordpress'; 'We do try to create a cross pollination by bringing in other teachers but our central thing is socio-constructivism because it is about conversation'; 'we also have constructionist where you learn through actually building, obviously it more suited to Second Life'; and 'problem-based education'.

- **Learning strategies**

A wide range of learning strategies was deemed useful by educators at UKZN, which confirm their inclusion as instructional functions of a VLS. Data extracts confirming learning strategies deemed useful were: 'active participation' ; 'group or collaborative work'; 'information seeking'; 'posting in blogs or discussion forums', 'internet and library resources searches'; 'creating artefacts'; 'simulation'; 'problem solving'; 'games'; 'open-ended questions and answers in forums'; 'learner engagement (posing questions, writing a review etc.) with multi-media, podcasts and other resources; 'chatting', 'Quizzes are given as a self-test to support learning'; 'getting students to think and to express themselves'; 'role playing'; 'peer reviews of essays'; 'learning portfolios'; and 'reflective journals'.

- **Instructional design strategies**

Educators at UKZN deploy a whole host of instructional design strategies, which confirm the need for these instructional functions to be incorporated into a VLS. Data extracts verifying these instructional strategies were: 'use of peer reviews and grading of peer reviews'; 'lecturer-led discussions'; 'designing and monitoring discussion forums as educational activities'; 'create online lessons with branching options'; 'provide students with links to relevant websites with updated content, online journals, e-books and free electronic resources'; ' teach students how to search for and seek relevant information independently'; 'use different techniques to cater for different learning styles'; 'grade students on the quality of their participation'; 'link words in the notes to an online glossary'; 'use videoconferencing facilities for interactive discussions with geographically dispersed students'; 'manage online discussion by actively posting'; 'differentiated instruction based on proficiency levels'; 'link quiz questions to a set of work'; 'give feedback on assessments'; and 'create course repository by uploading course content'.

c) Pedagogic challenges

Pedagogic challenges or barriers reported by educators interviewed at UKZN were as follows:

- Online discussion forums challenges, namely, 'students not trained to participate in online discussion forums'; 'lack of net etiquette guidelines for online communication'; 'online communication can be misconstrued (lack of tone)'; 'students find online discussion tedious';

‘lack of access as the university’s computer laboratory facilities are limited and every student does not own a laptop or home PC with internet connectivity to provide convenient twenty hour, seven day access to online discussion forums’; ‘online discussions with large numbers are complicated’; ‘the number of participants that can simultaneously optimally engage in an online chat is limited’ .

- Students' prior learning challenges, namely, ‘computer literacy problems among first year and mature students’; ‘students only taught the instructional way, and cannot take responsibility for their own learning in higher education’; ‘second language English users find it difficult to express themselves in written form’; ‘students have a mixture of learning capabilities’; ‘students from a rural background are being moved into the twentieth century overnight and are overwhelmed by the wealth of electronic resources’.

- Discipline specific challenges, namely, ‘practical work cannot be replicated online i.e. they have to be done using physical equipment in a laboratory setting’; ‘symbol based subject disciplines are not suited to online discussion forums’; ‘typing mathematical equations online is cumbersome’; ‘academic demands are so great that there is no time for online discussions or reflection on the learning process or peer review type educational activities’.

- Distance mediation challenges. Data extracts confirming this challenge were ‘you can’t pick up on visual cues’; ‘socio-emotional part of teaching and learning is not there’; ‘you can’t read the emotion with digital communication’ ; ‘something is lost by not being physically present’; ‘social, personal and emotional and the whole tone when someone says something so that’s an obvious loss’; ‘battle to nurture your students online’; ‘level of immersion is not the same, you don't get a sense of being at the same place at the same time’.

6.4.4.3 Analysis of the pedagogic theme for DUT and UKZN

A cross comparison analysis of the findings for the pedagogic theme at DUT and UKZN can be summarized as follows:

a) Both teacher and student centred pedagogic approaches were deployed underpinned by a combination of learning theories. This finding confirmed the differentiation of teacher and learner centred approaches by Brown and Peterson (2008) discussed in Chapter 4, section 4.3.1, which have implications for the design of learning environments such as VLSs.

b) Learning strategies were largely influenced by the discipline and ranged from individual problem solving, to collaborative and reflective learning, which reflected some of the seven principles of pedagogy as described in Chapter 4, Table 4.1.

c) Instructional design strategies were again influenced by the discipline needs and ranged from structured guided teaching, to differentiated instruction to cater for different learning abilities or styles; lesson activities for skills acquisition, and discussion forums among other educational activities. According to Wyles (2004b), activities associated with a learning topic should be able to be adapted according to the needs of an individual or learner sub-group as revealed by course interactions between the learner and their peers, system or instructor. Sub-groups must, therefore, be identifiable within the VLE once the learning activity is in progress. This requirement was expressed for both cases studies.

d) Educators were in agreement on the characteristics of online teaching, which revolved around online teaching and learning and online communication. These characteristics were, inter alia, flexibility, learner centeredness, collaborative learning, tracking of student progress, better course management, more teaching and learning styles and student feedback which confirmed the findings of McGill and Klobas (2009); Oliver (2001); and Song, Singleton, Hill and Koh (2004) discussed in Chapter 4, section 4.3.1. Some of these findings also supported an earlier study by Morgan (2003), who reported that VLS use allowed faculty to increase communication with their students; give students access to class documents; provide students the convenience and transparency of the grade book; include more interactive materials in their teaching; increase the amount of feedback and promptness of feedback to students; get students to hold discussions and engage with course materials in a slower paced manner.

e) The pedagogic challenges experienced by both institutions were of a generic nature and included the following : lack of differentiated learning, which supported the problem raised by Vovides et al. (2007); did not create a community of practice, which supported the findings of Egert et al. (2009); lecturers teach the way they were taught, which supported the viewpoint expressed by Dutton, Cheong and Park (2004).

6.4.5 Content category/theme D: System experience

Content category or theme D represents the demographic theme, system experience namely, length of VLS usage in years and the number of online/hybrid courses taught. This theme and subthemes have associated frequency counts illustrating prevalence of the subthemes coded/tagged from all the interview transcripts separated by case, covering the *demographic* interview question category (refer to Appendix 1). This theme addresses research sub-question 6 listed in Chapter 1, section 1.4. It is important to understand the role of experience in online teaching on VLS usage behaviour in residential institutions of higher education.

6.4.5.1 DUT system experience

The number of years of experience with using the system reported by educators interviewed at DUT ranged from 3 to 11 years with an average of 6.4 years. The number of unique online or hybrid course taught with a VLS ranged from 2 to 12 with an average of 3.6 courses.

6.4.5.2 UKZN system experience

The number of years of experience with using the system reported by educators interviewed at UKZN ranged from 1 to 11 years with an average of 6 years. The number of unique online or hybrid course taught with a VLS ranged from 1 to 9 with an average of 3.8 courses.

6.4.5.3 Analysis of system experience for DUT and UKZN

Experience with using the system at both DUT and UKZN were similar with some educators having more extensive experience of online teaching in terms of number of years and number of online or hybrid courses taught. According to Oliver and Moore (2008), learning to use a system and preparing materials for it was found to precede more interactive and collaborative uses of the tool. Oliver and Moore (2008) found that experience may play an important role in the web tools faculty employ as the faculty trend was to add tools to their repertoire. Experience with the use of technology (EUT) was found to play a major role with the acceptance of technology (Al-Busaidi & Al-Shihi, 2010).

6.4.6 Content category/theme E: VLS functions/features deemed useful and non-functional characteristics deemed important

Content category or theme E represents internal VLS functions/features deemed useful for online teaching and learning. This theme provides a more technical perspective as it relates to the system. This theme and subthemes are depicted in Tables 6.9 and 6.10 together with associated frequency counts illustrating prevalence of the subthemes coded/tagged from all the interview transcripts separated by case, covering the 'VLS functions and services needed for online teaching' interview question category (refer to Appendix 1). This theme relating to the perceived usefulness of system functions/features and the perceived importance of non-functional characteristics address research sub-question 2 listed in Chapter 1, section 1.4.

6.4.6.1 Blackboard functions deemed useful

The count of individual occurrences of the subthemes and basic themes within the Blackboard functions/features deemed useful category for DUT is summarized in Table 6.9. The results/outcomes for each of the subthemes and associated basic themes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.9: DUT Blackboard functions/features deemed useful

Organising theme	Subthemes and Basic themes	Sources	References
VLS functions deemed useful		**10**	**318**
	Communication and collaboration	**10**	**75**
	Online Threaded Discussion Forum	9	25
	Online Real time Chat	2	2
	News Forum	10	12
	E-mail	8	15
	Blogging	7	13
	Wikis	4	4
	Videoconferencing	3	3
	Shared Whiteboard	1	1
	Student involvement and productivity	10	13
	Course administration	**10**	**57**
	User management	9	15
	Course management	8	26
	Course Design	10	16
	Online Assessment	**10**	**90**
	Online tests	10	32
	Online assignment or project	10	17
	Online marking and grading	9	22
	Online Grade book	8	19
	Tracking and monitoring student participation and progress in online classroom	8	15
	Course Content	**10**	**49**
	Create content	8	13
	Content delivery and management	10	36
	System Challenges	6	19

a) Communication

The ‘communication and collaboration’ instructional function subtheme comprises a number of basic themes or sub-functions, namely, ‘online threaded discussion forum’, ‘online real time chat’, ‘news forum or announcements’, ‘e-mail’, ‘blogging’, ‘wikis’, ‘videoconferencing’, and ‘shared whiteboard’. The count of the individual occurrences of basic themes or sub-functions within the subtheme ‘communication and collaboration’, depicted in Table 6.9, show high counts for online discussion forums, e-mail, blogging and news forum and low counts for wikis, videoconferencing, online real time chat and shared whiteboard. These counts serve as an indication of the usefulness of the Blackboard sub-functions aligned to this instructional function. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Online Threaded Discussion Forum.** Data extracts related to this sub-function were: ’upload images to posts’; ‘automatic notification when new posts are made to forums’; ‘need the Web 2.0 type of functionality for discussion facility should be less formal’; ‘ integrate postings with e-mail notification would be useful’.
- **Online Real time Chat.** Data extracts related to this sub-function were: ‘‘keeps a record of a conversation/ record of chat sessions’; ‘students use it to chat among themselves’.
- **News Forum (Announcements and notices).** Data extracts related to this sub-function were: ‘announcements you can decide if it should pop up as soon as you enter the classroom or if it comes on after you click on it’.
- **E-mail.** Data extracts related to this sub-function were: ‘used to communicate new deadlines or new arrangements and there is a record of that, which is evidence if students challenge that at a later stage’.
- **Blogging.** Data extracts related to this sub-function were: ‘need indicators to see how many people have read your blog’; ‘it should automatically track students’ blogs’.
- **Wikis.** Data extracts related to this sub-function were: ‘I have made use of wikis in Blackboard’; ‘might be more useful for higher levels of study’.
- **Videoconferencing.** Data extracts related to this sub-function were:’ videoconferencing has to be managed’; ‘what I want is for Blackboard, is to have some support so that we can link up with industry, something like video conferencing. These individuals will have to apply to get access to the VLS’; Video conferencing is needed especially if you got distance learners so you can get them together by means of video conferencing, you can talk to them’.
- **Shared Whiteboard.** Data extract related to this sub-function was: ‘tried whiteboard couldn’t get it to work’.

b) Student involvement and productivity

The ‘student involvement and productivity’ instructional function subtheme count of the individual occurrences is an indicator of its usefulness by educators at DUT. Data extracts verifying usefulness of this instructional function, associated properties and additional properties needed were: ‘Blackboard course calendar with deadlines’; ‘Should support bookmarks’; ‘Student should personal calendar to manage his/her own learning’; ‘online reflective journals I think maybe for Bachelor of Technology students'; 'useful to incorporate portfolios through a journal'; 'the reflective journal is a useful feature'; 'The students can edit their profiles'.

c) Course administration

The 'course administration' instructional function subtheme comprises three basic themes, namely, 'user management', 'course management', and 'course design'. All of the Blackboard sub-functions aligned to this instructional function were deemed to be useful by educators at DUT. The count of the individual occurrences of basic themes within the subtheme 'course administration', depicted in Table 6.9, from highest to lowest is: course management, course design, and user management. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **User management**

  Data extracts related to this sub-function were: 'user registration is done centrally'; 'it would be nice to have your class lists loaded automatically onto the system'; 'Blackboard has a function where you can divide the class into groups and the posts would be acknowledged as a group';' should give students more privileges, their own classroom'; 'lecturers should be given rights to reset password automatically'.

- **Course management**

  Data extracts related to this sub-function were**: '**change/edit course'; 'archive courses'; 'back up courses supported'; 'recording of marks and being able to see who's handed in an assignment'; 'educators should be able to register courses on system'; 'course registration at DUT was done centrally'; 'supports online surveys'**;** 'keeps a record of students' work';' should upload files to the correct folder'; 'server space for saving students work/files'.

- **Course design**

  Data extracts related to this sub-function were: 'copying courses and rolling them over is supported'; 'hide courses being developed is supported'; 'Hide documents, hide course material or learning objects; 'course templates or layouts are needed'; 'selective release of documents e.g. release solutions only when everyone has submitted; release the test marks and the solutions at the same time'; 'by clicking an object it should open up'; 'the system should allow the course facilitator to structure course in terms of what tools is needed but the interface is fixed'.

d) Online assessment

The 'online assessment' instructional function subtheme comprises a number of basic themes or sub-functions, namely, online tests, online assignment, online marking and grading, and online grade book functions. All of these Blackboard functions were deemed to be useful by educators at DUT. The count of the individual occurrences of basic themes or sub-functions within the theme 'online assessment' depicted in Table 6.9 from highest to lowest is: online tests, online marking and grading, online assignment, and online grade book. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Online quizzes and tests**

  Data extracts related to this sub-function were**:** 'should allow one to embed more than one image into a quiz question'; 'should be able to import objective type questions from Word or test banks into Blackboard'; 'allows quizzes only for self-assessment purposes with no grading'; 'allows you to randomise your test questions and answers'; 'should scramble order of test questions'; ' should allow test run of assessment tool prior to actual test'; 'should prevent students from submitting in the middle of a test'; 'should be able to set mark allocation for individual questions'; 'should make short question answers to be case insensitive' ; 'when the student finishes the assessment, an e-mail notification is sent through to the instructor'.

- **Online assignments**

  Data extracts related to this sub-function were**:** 'allows submission of group assignment'; 'peer review of assignments at postgraduate levels was regarded as a useful feature'; 'allows online submission of assignments'; 'I would like a scale to customise during marking'; 'control deadlines for assignments'; 'return assignments with comments to students'; 'gives confirmation of online submissions'; 'has ability to turn the assignment back for further work'; 'should allow the download all submitted assignments collectively instead of individually'; ' should also allow the upload of all marked assignments collectively instead of individually'; ' has digital box for assignment submission'; 'central place where student download assignment questions, upload assignments and download marked assignments'.

- **Online marking and grading**

  Data extracts related to this sub-function were**: '**the system can automatically mark objective type questions like multiple-choice questions'; 'allows assessment feedback with comments and grades'; 'exporting is there, importing I'm not sure about'; 'online marking should allow for comments to be made directly to assignment using a review function similar to that in Word'; 'I use the grading forms a lot; I find the criteria and indicators quite useful, however the grading form does not allow you to comment and give a mark or grade on the quality aspects of the essay'; ' I set up a grading scale in Blackboard'; 'students can see their grades and lecturer's comments '; 'grading scales should be more flexible than current scales of very poor, poor, satisfactory, almost like a Likert scale'; 'the online marking tool require an enormous amount of capital but the value is amazing because as soon as they answer the quizzes (MCQ, True and false) they get immediate feedback'; 'options where I could delay feedback or delay release of test marks'.

- **Online grade book**

Data extracts related to this sub-function were**:** 'Grade book organises and records marks'; 'grade book allows students to view/monitor their progress'; 'publishes marks online'; 'assignment names should be abbreviated so as to view all assignments together'; 'lecturers can track students grades in a course over time'; ' Blackboard should allow awarding of bonus marks'; ' should allow educators to provide weighting for the assessments'; ' performs statistical analysis, generates mean, lower, higher, medium, standard deviation per question'; 'would be great if students could compare their marks/monitor their learning with the rest of the class. It would be valuable if this functionality could be built into it and people always like to compare themselves'; 'keeps track of our individual student's marks for continuous based assessment because we want the students to get feedback and get the chance to redo it'; 'allows overriding marks for blog posts as it cannot judge the quality of the posts'; 'should be able to export marks from grade book to the integrated tertiary system (ITS)'.

e) Tracking student participation and progress in online classroom.

The 'student tracking' instructional function subtheme in Blackboard was deemed to be useful by educators at DUT as evidenced by the count of individual occurrences of this subtheme. Data extracts confirming the need for or usefulness of this instructional function were**: '**Tracking student participation'; 'track students online activities'; 'Track students contributions to discussions supported'; 'Tracking student progress' ; 'tracking facility to see how many people visit the classroom'; 'keep track of student submissions'; 'student monitoring'; 'I would like an activity report on how many times they commented on a post, as a lecturer I need to check where students have been and what they have done'.

f) Course content

The 'course content' instructional function subtheme comprises two basic themes or sub-functions namely, 'course content creation' and 'course content delivery and management'. The Blackboard sub-functions aligned to this instructional function were deemed to be useful by educators at DUT. The count of the individual occurrences of basic themes within the subtheme 'course content' depicted in Table 6.9 show a much higher incidence of the 'content delivery and management' basic theme than ''course content creation’. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Course content creation**

  Data extracts related to this sub-function were: ‘create content (lessons, quizzes, tests, learning objects, glossary definitions, websites, and dynamic web pages)’; ‘Frontpage and Dreamweaver was used to create dynamic web pages for courses’; ‘HTML editor creating content’; ‘should support more interactive website design’; ‘supports hyper linking’; ‘in the learning module of the Blackboard environment you can put in internal and external links. You can link to pages or bulk of pages. You can create lessons using this tool where they have a link to the content of a particular topic, and to a quiz to test their knowledge of the topic’; ‘From the learning module you could also link up to the glossary’; ‘Create websites’; ‘Create learning objects using the learning module tool that are reusable’; ‘glossary should support uploading images, pictures and videos’, ‘glossary upload rather than entering definitions individually’.

- **Course content delivery and management**

  Data extracts related to this sub-function were:

  - *Support a variety of data formats*, namely, ‘importing different formats like Word and Excel documents’; ‘should support flash player, windows media player’; ‘I do use videos in a PDF because it’s easy. It’s embedded in a file they have to click on it and it opens.’; ‘mp3, audio files would be vital depending on the bandwidth’; ‘media library stores (images)’; ‘media library items can be categorized’.
  - *Post links to external resources*, namely, ‘link students to various resources like online journals’; ‘links to useful websites’; ‘links to multimedia resources’; ‘links to YouTube videos’.
  - *Distribute course content*, namely, ‘notes’, ‘syllabi’ ‘articles’;’ assessment methods’; ‘Word and Excel format is problematic when importing to Blackboard, it slows up as the notes needs to be done in FrontPage, PDF is fine’; ‘I put a lot of the unproductive activities like note taking online. Students do not need to take down notes. I’m talking even about exercises’; ‘I have taken the course content and put it on Blackboard in the form of slides’; ‘system should have floating documents capability’.
  - *Online classroom information*, namely, ‘rules and guidelines for online course’; ‘feedback timeframes for student queries’; ‘expectations and requirements of online learning’; ‘online office hours’.

g) System Challenges

The following 'system challenges' subtheme in Blackboard had a substantial count of individual occurrences, as depicted in Table 6.9, and reported by educators at DUT. The 'system challenges' subtheme comprises a number of basic themes as follows:

- *Discussion and collaboration challenges* supported by the following data extracts:' this tool should resemble Web 2.0 type of functionality. The tool is clumsy and too formal. Furthermore it was difficult to keep track of the threads. It needed to be less structured and more spontaneous'; 'Blackboard does not send a notification to students when a notice is posted to them'; 'The blogging tool within Blackboard was found to be cumbersome to use'; 'Difficult to upload pictures in the discussion forum in Blackboard not sure whether it was a system issue or hardware and software in the LANS'; 'There's no wiki option in Blackboard you have to use an outside wiki. You have to bring it in as an external link and then we need a password to get into that. The problem is that the students forget their passwords'.

- *Course design challenges* supported by the following data extracts: "when I am designing my stuff I don't really know if it works until the student views it and gives me feedback'; 'system should make the educator a facilitator not dictator'; 'it does not support flash and interactive website design. By clicking an object it does not open up'.

- *System design challenges* supported by the following data extracts: 'no direct communication between designers of software and users to alert them on things that are not working out as they were planned to work out'; 'Blackboard has a hierarchical power structure where power is concentrated in the hands of a few like the facilitator and teachers with little power being given to the students who are more at the consumer level'; 'from a design point of view, which is what I would really like to use it for but can't is it takes too long to upload or to draw a line'; 'No you can do a drawing online, but it's yeah cumbersome'; 'the tools in Blackboard are separate. They do not seamlessly integrate into one comfortable flowing environment. Students would not naturally gravitate towards that environment'; 'But then the way they are structuring these tools there's the discussion, there's the learning module and then you have the home page'; 'you can hyperlink everything but you get lost navigating'; 'we have a lot of problems with browsers supporting Blackboard when you open it on the Mac it does weird things.'

- *Course management challenges* supported by the following data extract: 'sometime I need to upload twice and then re-position the item on the page and I often try to move it and it doesn't; does not load the data to the correct path, just loads it. Sometimes it just would not work'.

- *Course content challenges* supported by the following data extracts: ‘prefer glossary-upload rather than entering definitions individually’; ‘you could upload a video into Blackboard but it didn’t play’.

- *Online marking and grading challenges* supported by the following data extracts: ‘There was no substitute for the review function capability of Word processing packages’; ‘System should allow for peer comments and not necessarily for grading purposes as students are not knowledgeable enough to grade other students work’.

- *Assessment, assignment and grade book challenges* supported by the following data extracts: ‘You cannot go into Blackboard and change anything like from MCQ to short answers it doesn’t do that because it keeps a statistic of the test over time’; ‘Doesn’t allow one to upload more than 1 image for each online test question’; ‘Doesn’t scramble the order of test questions’; ‘Grade book could be more effective/flexible with regards to in-depth feedback’; ‘Setting up group assignments in Blackboard is very complicated. You had to go the settings for the assignment, then go out of that module and allocate groups elsewhere’; ‘Downloading assignments individually for marking and then uploading marked assignments individually and entering the mark for each student is time intensive’; ‘Assessment names should be abbreviated so that the lecturer can view all assignments without having to scroll unnecessarily’.

6.4.6.2 UKZN Moodle functions/features deemed useful

The count of individual occurrences of the subthemes and basic themes within the Moodle functions/features deemed useful category for UKZN is summarized in Table 6.10. The results/ outcomes for each of the subthemes and associated basic themes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.10: UKZN Moodle functions/features deemed useful

Organising Theme	Subthemes and Basic Themes	Sources	References
VLS functions deemed useful		**16**	**452**
	Course communication and collaboration	**15**	**95**
	Online threaded discussion forum	14	29
	Online real time chat	6	12
	News forum	6	6
	E-mail	9	12
	Blogging	5	9
	Wikis	7	10
	Videoconferencing	3	12
	Shared whiteboard	5	5
	Student productivity and involvement	**12**	**23**
	Course administration	**16**	**103**
	User management	15	40
	Course management	14	33
	Course design	12	30
	Online Course Assessment	**16**	**119**
	Online tests or quizzes	13	38
	Online assignment	11	23
	Online marking and grading	13	39
	Grade book	14	19
	Tracking and monitoring student participation and progress in online classroom	**12**	**18**
	Course Content	**16**	**71**
	Course content creation	8	10
	Course content delivery and management	16	61
	System challenges	**9**	**23**

a) Communication and collaboration

The 'communication and collaboration' instructional function subtheme comprises a number of basic themes or sub-functions, namely, 'online threaded discussion forum', 'online real time chat', 'news forum or announcements', 'e-mail', 'blogging', 'wikis', 'videoconferencing', and 'shared whiteboard'. The count of the individual occurrences of basic themes or sub-functions within the subtheme 'communication and collaboration', depicted in Table 6.10, show high counts for online discussion forums; average counts for e-mail, blogging, wikis, videoconferencing, online real time chat and low counts for news forum and shared whiteboard. These counts serve as an indication of the usefulness of the Moodle sub-functions aligned to this instructional function. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Online threaded discussion forum.** Data extracts related to this sub-function were**:** 'free fold in the conversation, and conversation central where you can upload and tag files'; 'keep a record of the conversation, which allows participants to go back and search for things, where they had gone on wrong path or track in the discussion'; 'Scaling of conversations is useful if you have tags and a bit of data mining can be performed'; 'need for separate channel of communication or forum for co-teachers on a course or module'; 'should resemble a face book type of environment'; 'asynchronous communication is very important, online discussion forum is very helpful'; 'use e-mail integration with forum postings'.

- **Online real-time chat.** Data extracts related to this sub-function were**:** 'We conducted our session via the live chat and kept a record of our session'; 'If you are doing distance you still have to think of how to run a distance module. There is still a process where somebody engages with the students and the interaction is online and can be synchronous'; 'Having a chat they can ask their questions and the text comes much faster'; 'The chat room could be accessed via a web interface or via a mobile'; 'the real value is so you have a record of a conversation'.

- **Course announcements/ news forums.** Data extracts related to this sub-function were**:** 'news forums Yeah that would be useful'; 'It's about keeping in contact with the students'; 'a mobile application for Moodle where students can access get notices on their mobiles; see what readings are there'.

- **E-mail.** Data extracts related to this sub-function were**:** 'I could then send out e-mails to the students instead of going to the secretary'; 'you have got twenty four seven access so you can post a note and I see the note comes to my e-mail and someone has a query'; 'Generally speaking our contact with the students is by face to face and by e-mail'; 'They rather just e-mail me with the Blackberry'.

- **Blogs.** Data extracts related to this sub-function were**:** 'blogs would be useful'; 'I quite like the idea of blogging'; 'my most important things would be things that support communication that would be all sorts of blogging, micro blogging';' we use a lot of blogging for multiple reasons'.

- **Wikis.** Data extracts related to this sub-function were**:** 'wikis I suppose it could be useful';' 'supporting collaborative work through a wiki'; 'making use of wikis to construct so we used them in the past where we will give them topics and put them in a group and they actually build the article together and I think there is quite a lot of value in that ability to construct'; 'wikis are very important as constructionist based thing and leaving artefacts behind'; 'Wikis hasn't taken off. They could be useful'.

- **Video and/or voice conferencing.** Data extracts related to this sub-function were**:** **'**the videoconferencing would be very useful'; 'We used Dimdim we had problems with the Dimdim and I believe they are going to integrate something similar and that would be great especially since we do have distance students'; 'We used Dimdim because it was both voice and video with desktop sharing'; 'Through video conferencing we can link to 5 or 6 different places at a time, so it depends on the size of the video conferencing group'.

- **Shared whiteboard.** Data extracts related to this sub-function were**:** 'presentation on whiteboards are used hand in hand; we annotate on the presentation with extra drawings, extra explanations'; 'Haven't used smart board functionality mostly because I think that would make a lot of sense if you had more taught lessons'.

b) Student productivity and involvement

The 'student involvement and productivity' instructional function subtheme count of the individual occurrences in Table 6.10 is an indicator of its usefulness by educators at UKZN. Data extracts verifying usefulness of this instructional function, associated properties and additional properties needed were: **'**I got the students to do profiles'; 'Profiles with their pictures, being able to introduce yourself, is more conducive to discussions'; 'student profiles very important for students to develop a professional identity'; 'time management and the use of calendars I find very useful';' the calendar brings in time management and knowing our schedule and that's useful'; 'Organisational and time management tools would be nice because it keeps the students more involved on their own learning'; 'one central calendar where you can put all the key dates so its reminding them what's coming up'; **'**I require students to keep a journal in my course'; 'Sometimes they work in groups'; 'In Moodle there is an online journal that you set up. I like that it is available online and I like people to be reflexive about their learning'.

c) Course administration

The 'course administration' instructional function subtheme comprises three basic themes, namely, 'user management', 'course management', and 'course design'. All of the Moodle sub-functions aligned to this instructional function were deemed to be useful by educators at UKZN. The count of the individual occurrences of basic themes within the subtheme 'course administration', depicted in Table 6.10, from highest to lowest is: user management, course management, and course design. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are described below.

- **User management.** Data extracts related to this sub-function were**:** ‘I really prefer when the students are registered they are automatically into the module. Moodle allows it’; ‘I would like to upload class lists directly’; ‘authentication via e-mail address’ ,’ limit access to registered users’; ‘I did find the group function very useful it also got the students forming their own groups’; ‘I do a lot of organisation of them into groups like I can send a message to the postgraduate students or just to the masters’; ‘Some of the workshops are for pure assessment are group tasks so they do a group weekly document’; ‘I think of our course and most of our courses have guest access, which makes it less complicated’.

- **Course management.** Data extracts related to this sub-function were**: ‘**authorised courses that is very useful’; ‘backing up is also very good’; ‘all our courses have passwords on it’; ‘selectively release course content to different practical groups’; ‘If you are away from campus on a conference the system releases documents according to the conditions that are set e.g. on a specific day or when a condition is met’; ‘we should be running with a decent web management system or web portal system so that everyone can have a customized front-end… what your calendar looks like if you a student or a lecturer, your e-mail’; ‘ability to archive courses so you don’t lose it and can keep the same structure’; ‘agree with students evaluating the quality of online learning’.

- **Course design.** Data extracts related to this sub-function were**:** ‘Educators need to structure or organize their courses using a pre-defined format such as weekly or topics or using templates if available. It allows you to organise your courses’; ‘The fact you can hide certain documents and then make them available is also useful’; ‘change/edit your own course’; ‘What’s nice in Moodle is being able to decide what you want the students to have so like a calendar or news forum or something like that so you can play around with that structure’; ‘need for a separate welcome page that allowed progamme level communication to all students in a discipline’; ‘You should be able to do all of those things i.e. copy and hide courses being developed’; ‘I did like the fact that I could hide the course while I was developing it and once the course was completed I actually closed them off. They were no longer available to anybody’.

d) Course assessment

The ‘online assessment’ instructional function subtheme comprises a number of basic themes or sub-functions, namely, online tests, online assignment, online marking and grading, and online grade book functions. All of these Moodle sub-functions were deemed to be useful by educators at UKZN. The count of the individual occurrences of basic themes or sub-functions within the subtheme ‘online assessment’, depicted in Table 6.10, from highest to lowest is: online marking and grading, online quizzes and tests, online assignment, and online grade book. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Online tests and quizzes**

  Data extracts related to this sub-function were**:** 'I had 120 multiple choice questions so I imported them but I had to strip off all the formatting'; 'we run quizzes for first years'; 'importing is easy once you learn the format its fine. Is a useful feature'; 'If it is an online test it opens at 8h30 and closes at a specific time'; ' I need to embed pictures into quizzes, because I teach applied mathematics, which is all drawings'; 'They have to finish a certain number of quizzes so that we know that they have covered the content. So it's factual testing'; 'You can give back feedback immediately to say this is what you scored or delayed feedback to say what the right answers were once everyone has taken the assessment'; 'Moodle should have a client for developing multiple choice questions, which is something that runs on your machine and that you build the questions and upload them, that would be nice'; 'In Moodle you randomise your tests and your answers'; 'the system should have built in semantic understanding to change the way the question is asked without changing the meaning of the question as well as ask additional questions on information around the answer thereby creating new questions'; 'select what assessments can be viewed by students and count towards class marks, by choosing the appropriate settings for each assessment'.

- **Online assignments**

  Data extracts related to this sub-function were**:** 'uploading assignment question file (s)'; 'a nice to have feature is they can submit their assignments online'; 'the students can only see their own assignment'; 'the ability to post assignment question, control the date it is posted, provide comments collaboratively and then return to the student'; 'have an online repository of all student assignment submissions with comments and final grades'; 'Deadlines for assignment submission, link to upload assignment is closed'; 'set group or individual submission'; 'submission of assignment using single or multiple files'; 'automatic notification upon submission to lecturer'; 'allow for re-submission of assignments'; 'peer review where students submit assignments and their peers comment on it'; 'The weighting for peer review of assignments is set by the individual lecturer (s) in a course'; 'It's easier to do peer evaluation if it is group submission rather than an individual submission'; 'the workshop is where you do the peer review which are a clunky thing to set up but it works fine'; 'The only thing I have used like that is in the workshop you can save comments and so I use that quite a lot ; students submit in the workshop and its marked in the workshop marking is done by us not by the system'.

- **Online marking and grading**

Data extracts related to this sub-function were**:** ‘should be able to set custom scales for grading’; ‘set up marking criteria on online marking forms where final grades are awarded’; ‘I would like to mark with red inside their actual assignments and load marked assignments back to them’; ‘make comments on assignments similar to review function in Word’; ‘I like the integration of Turnitin into Moodle’; ‘Turnitin helps against plagiarism, which is excellent’; ‘need for an online marking template, which can be adapted’; ’Grading of peer reviews’; ‘online marking tool’; ‘We give a participation mark **-** How many times did you post to a blog? How many times did you comment on someone else’s comment and what was the quality’; ‘the ability to give feedback directly online’.

- **Online grade book**

Data extracts related to this sub-function were**:** ‘Offline assessment grades have to be manually entered into Moodle grade book’; ‘It won’t import from Excel. It does export very nicely’; ‘import/export to Excel that’s nice to have’; ‘I think you can select what you want displayed in terms of students’ marks’; ‘assign group assignment mark to all group members’; ‘perform statistical analysis’; ‘graphing ability to depict results’; ‘the system puts the marks in by itself, I don’t know how to get my weights in that I put onto student management system (SMS)’; ‘I agree with track students grades in a course over time’; ‘I still pull the marks out and do a statistical analysis it doesn’t allow me to do that you have to go into Excel to do that’; ‘the workshop generates the final marks , it’s got a formula that weights the marks in some way against the average for that assessment’; ‘tracking students grades, like if something could flash and tell me this guy is battling that would be fabulous’; ‘easy scrolling with column and row headings locked’.

e) Student tracking

The ‘student tracking’ instructional function subtheme in Moodle was deemed to be useful by educators at UKZN as evidenced by the count of individual occurrences of this subtheme in Table 6.10. Data extracts confirming the need for or usefulness of this instructional function were**:**: ‘I see who has posted, what they have posted and the participation mark is based on how often they participate’; ‘Tracking students’ grades is useful they are able to see all their grades and how they are doing’; ‘graphs that Moodle generates that tells you the hours they spend on Moodle per week; when they logged in and logged out; what they changed what they used, what they read, what tests they have taken’; ‘you can see who are the students that are logging in regularly, to see what going on with the module or the programme, and you can see those that are lazy and taking their own time’; ‘That’s one thing that we can see that students use. They can check on their marks’; ‘Moodle gives you activity reports’.

f) Course content creation and management

The ‘course content’ instructional function subtheme comprises two basic themes or sub-functions namely ‘course content creation’ and ‘course content delivery and management’. The Moodle sub-functions aligned to this instructional function were deemed to be useful by educators at UKZN. The count of the individual occurrences of basic themes within the subtheme ‘course content’, depicted in Table 6.10, show a significantly higher incidence of the ‘content delivery and management’ basic theme than ‘‘course content creation’. Data extracts verifying the basic themes or sub-functions deemed useful, associated properties and additional properties needed are shown below.

- **Content creation**

  Data extracts related to this sub-function were**:** ‘create definition of terms or concepts in a course dictionary/ glossary’;’ One thing that would be useful would be to have your notes online and have the words linked to glossary’; ‘The glossary is a good learning tool as students may be required to define terms for subject vocabulary’; ‘It is still an interactive thing they can go in and ask questions they can add to, they can change glossary entries’; ‘Glossaries can be linked to learning activities and tests’; ‘Glossary entries you write yourself or edit fully can be useful’; ‘Creating lessons with the ability to branch out’; ‘create lessons with spell checking capability’; ‘I created content like quizzes on Moodle’; ‘course creators should be able to attach meta data on learning materials, needs instruction as to what it can be used for, what purpose, what content can be used’; ‘Creating learning portfolios and home pages is important’; ‘they supposed to write on that topic using the Wikipedia as a model and produce a Wikipedia type page’.

- **Content delivery and management**

  Data extracts related to this sub-function were**:**

- *Support for a variety of data formats:* ‘The use of multi-media content namely audio, video, podcast, and animation to scaffold the learning process’; ‘support embedding of code from providers of multimedia content. Lecturers should be provided with the option to take the link or embed code. If they choose the latter YouTube plays videos on your local site’; ‘play PDF slide shows’; ‘play podcasts’; ‘use or incorporate multimedia such as MP3s and video clips’; ‘The use of video and or podcasts to explain mathematical concepts was found to be useful as lecturers would not have to explain the same concepts over and over again’; ‘You know sometimes there’s a video of a mock trial so that’s quite nice with professional training to show how it works’; ‘stuff like photographs, videos I just link them’.

- *Post links to external resources:* ‘ability to link to electronic textbooks and student resources some of which is available free of charge’; ‘see what was available on the internet and just provide the links'; 'links to online journals'; 'we can post URLs so they can download the research papers'; 'provide students with links to relevant websites that have updated content'; 'post links to virtual practical, it will show them exactly how things will happen in the Lab'.

- *Distribute course content:* **'**Students mainly used the VLS to get their practical work and assignments, learning objectives, student guides, and course outlines'; 'provide notional study hours that is the amount of time students are expected to spend on each learning activity'; 'transparency how you are going to assess online activities'; 'clear syllabi outline'; 'document all course events in a course outline at the beginning of the year namely syllabus, frequency and nature of assessments, mark breakdown etc.'; 'all pedagogical aspects such as learning objectives, student guides, course outlines'; 'post course content (lecture notes) and course related material such as tutorials, tests and exam papers and their solutions'; 'create a resource library of pertinent readings and articles of interest'; 'you can put your entire learning guide from one to fourteen'; 'facility to upload, share, tag, store, organize, hide, and remove files/ documents together with folder creation, naming, and removal capabilities'. 'Files should be arranged alphabetically in a folder to facilitate easy retrieval'; 'we built up a resource library of materials and we load up that as well'; 'having my lecture notes available that's the most useful thing'; 'The other thing I find useful is that we can link to websites that may be of interest to the students, they get a much broader view of things and included in that is that we are shifting to using online textbooks' ; 'put all course events in a course outline at the beginning of the course'.

- *Online classroom information*: **'**online study help/hints'; 'another contractual think you can have with your students you can say these are the general rules for net etiquette'; 'you set the guidelines for interaction'; 'Ground rules for the class'

g) System Challenges

The following 'system challenges' subtheme in Moodle had a substantial count of individual occurrences, as depicted in Table 6.10, and reported by educators at UKZN. The 'system challenges' subtheme comprises the following basic themes:

- *Discussion challenges* supported by the following data extracts: 'The blogging facility in Moodle should resemble Facebook blogging'; 'communicating in mathematics using forums is cumbersome'.

- *Course design challenges* supported by the following data extracts: 'every word has to be entered into the glossary separately, asks for html language, very frustrating. I would really like that thing to work properly'; 'I think it's very important to have a variety of pedagogic approaches, but it's not adjustable at the moment It is still based on the idea when you come into the classroom everybody does the same'.

- *System design challenges* supported by the following data extracts: 'I think that an important thing that we don't have in Moodle is a sort of a welcome page where a student's logs in and all the courses registered for are there. Programme co-ordinators need to send administrative type messages that affects all students registered for a particular programme'; 'Moodle does not allow you to comment on PDF files'.

- *Content management challenges* supported by the following data extracts: 'In Moodle you have to upload to a folder and it's not arranged in an alphabetical sequence'; 'no facility to capture metadata for content'.

- *Online marking challenges* supported by the following data extracts: 'I had to type in my marking scheme in the comments sections for each one of the assignments'; 'the online marking should be improved and allow me to load on the marking criteria as I have to do my marking criteria in Word and then copy and paste into the little comment box for every student'; 'The only problem with group assignments was that although you were in a group it only marked the group assignment as done by one student and it was not attached to the group'.

- *Assessment, assignment and grade book challenges* supported by the following data extracts: 'students ability to create tests and quizzes is not there'; The system asks for an activity number, I sometimes I get confused and I don't know if it has an effect on the grading'; 'it's tedious writing Moodle questions when the network is slow'; 'Creating quizzes for mathematics is cumbersome as you have to type in latex and then put it into Moodle'.

6.4.6.3 Analysis of VLS functions/features deemed useful for DUT and UKZN

A cross comparison analysis of the instructional subthemes for category 'VLS functions/features deemed useful' is discussed as follows:

a) Communication

Educators at both institutions agreed on the usefulness of the communication features of the VLS used, which were consistent with the communication tool functions described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1. The features of this tool that had higher counts at DUT were online threaded discussion forum, e-mail, blogging and announcements whereas at UKZN the online threaded discussion forum had a high count followed by average count values for e-mail, blogging, wikis and videoconferencing. Barron (2003) confirmed the usefulness of an internal email system for each course, in order to keep all communication in a separate, sharable location, and provide an inbox and outbox with automatic backup of all messages sent and received. Posting in threaded forum discussions designed by the lecturer was the main tool reported to be used for learning, discussion and debate in the online environment. Educators reported mixed experiences with online discussion forums. Some educators at UKZN found that students were less inhibited and more frank in online discussions than they were in face-to-face discussions whilst others reported that students' uptake of online discussion forums was poor and generally one way from lecturer to students where no mark was awarded for online participation. The 'transmission' model of information is commonplace in current VLSs because it is far easier compared to the interactivity implicit in a conversation (Wyles, 2004b). Another viewpoint was that online discussion forums were very cumbersome and involved a lot of reading and writing and was time consuming. Discussion forums were not used for the mathematics discipline as typing of mathematical equations was reported to be cumbersome. Staff found it much simpler to write mathematics than type mathematics. As it is a residential university, there are scheduled classes where face-to-face discussion takes place.

The notice board or news forum was also reported very useful to make announcements and convey messages to students.

Educators that used blogging found it to be a useful tool for students to participate in discussions and contribute to the learning of a topic or subject area.

b) Student productivity and involvement

Educators at both institutions agreed on the usefulness of the student productivity and involvement features, which were consistent with corresponding functions and properties described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1. The course calendar, which is both a planning and communication tool, was reported to be useful as it had an updated record of course events such as test and exam dates and submission deadlines for projects and/or assignments. The online student journal allowed students to reflect on their learning process. Britain and Liber (2004) emphasised the incorporation of personal development planning (PDP) tools; self-organising activities, e.g., clubs, study groups and unmonitored communications; and a time management tool for learners (Wyles, 2004a).

c) Course administration

Educators at both institutions agreed on the usefulness of the course administration features, which were consistent with the course administration and management functions and properties described in Chapter

2, Table 2.1 and Chapter 3, Table 3.1. Course management and course design was regarded as useful by interviewees at DUT and UKZN. However, the user management function was performed largely by an administrator at DUT and was, therefore, regarded as less useful than course design and course management. A number of properties of the various functions were reported useful and additional properties were recommended that would enhance usage. Access privileges in terms of multiple level access privileges (not only student/teacher), and registration options such as LDAP, batch and self-registration were considered important for adoption of an open source system (Botturi, 2004). The administration tools provided in a VLS are authentication; course authorization and registration integration (Wcet, n.d.-a), as described in Chapter 2, section 2.3.1.

d) Online course assessment

Educators at both institutions agreed that the following sub-functions comprising the online course assessment instructional function were useful:

- The ability to create and administer quizzes and online tests, was deemed to be most useful by educators at both institutions, particularly for first and second levels of the undergraduate programme, while some reporting that quizzes were used as self-tests in postgraduate programmes. These findings confirm the need for automated testing management functions in a VLS, as summarised in Chapter 2, Table 2.1 and Chapter 3, Table 3.1.
- Objective type questions in the form of multiple choice questions, true or false, matching and fill in the banks was the popular choice for online testing as it can be automatically scored. The choice of online questions was consistent with test type functions and properties that should be/are incorporated in a VLS, as summarised in Chapter 2, Table 2.1 and Chapter 3, Table 3.1.
- The online assignment and online marking and grading sub-functions were welcomed by educators at both institutions, which were in keeping with the assignment-specific digital drop box, online marking and online grade book functions and properties summarised in Chapter 2, Table 2.1 and Chapter 3, Table 3.1.
- Peer reviews of assignments were reported to be of particular importance to educators involved in post-graduate programmes where fellow students were required to provide constructive critique of their peer’s work. In addition, educators’ assigned grades to peer review of assignments so that students took this activity seriously. Peer reviews were given a particular weighting attached to the final mark awarded for assignments. The peer assessment property was described under Moodle’s assignment-specific digital drop boxes in Chapter 3, Table 3.1.
- Barron (2003) proposed that online grade books should be able to assign weights to the assignments; apply formulas to determine final grades; and be uploaded and downloaded in common formats as Excel. The usefulness of these properties was confirmed in this study, and

was consistent with grade book properties described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1.

- According to Barron (2003), the assignment specific digital drop box is a valuable tool as it provides a designated area for assignment submissions as opposed to sending assignments as e-mail attachments. A further recommendation made was that a customized drop box should be configured for each assignment allowing instructors to post messages related to a specific assignment and listing the total number of points allocated (Barron, 2003). The assignment drop box as described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1 was considered was considered to be useful, and further improvements to the tool features was welcomed.
- Barron (2003), as discussed in Chapter 2, section 2.3.2, highlighted the need for assessment options to be included in a VLS for online quizzes; a supplemental exam tool to create quizzes offline to import into a VLS; a student presentation area providing server space to upload student projects and showcase their work and the use of Adobe Acrobat and PDF files for online marking of electronic assignments where instructors can overlay in-depth freehand comments in coloured text on PDF documents while preserving the original submission. All of these needs were supported in this study.
- In a study conducted by Martin (2008), on the usefulness of Blackboard features from the perspective of instructors and students, it was reported that assignments, grade book and course documents were the most useful. The availability of immediate feedback for online quizzes was reported to be the most helpful feature. These findings were to some extent, confirmed by this study in that online submission of assignments, availability of immediate feedback for online quizzes, and course documents were reported to be useful. However, the grade book was met with mixed reactions. While many of the educators interviewed at both institutions acknowledged the usefulness and value of having a grade book in a VLS, it was the least used component of Blackboard and Moodle as many educators preferred using the spreadsheet tool for recording marks/ grades, performing statistical analyses, and calculating class and final marks.

The online assessment tools were perceived to be extremely useful especially for creating and administering objective type assessments in the form of quizzes. Educators welcomed the peer reviewing facility for postgraduate assignments. They expressed the need for a supplemental exam tool to create quizzes offline and recommended various enhancements to the existing online assessment tools included in the VLS. Some of the functions of the grade book were not perceived to be useful since an adequate tool in the form of spreadsheets was available to perform statistical calculations.

e) Student tracking

Educators at both institutions agreed on the usefulness of student tracking features of a VLS, which were consistent with the corresponding function and properties described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1. Some educators required tracking of student participation in threaded forums and chats in an online environment. It was suggested that a VLS provide activity reports, usage statistics and frequency of student participation in various forums to assist the lecturer in assigning final student participation marks. Student tracking, where teachers can see student data and activities, was one of the key functions considered for adoption of an open source VLS (Botturi, 2004)**.**

f) Course content creation and management

Educators at both institutions agreed on the usefulness of the course content creation and management features of a VLS, which was consistent with the content authoring, delivery and management functions and properties described in Chapter 2, Table 2.1 and Chapter 3, Table 3.1. The 'Course content delivery and management' sub-function was clearly found to more useful than the content creation sub-function at both institutions. This need for the course content management function was confirmed by Barron (2003) who stated that a VLS should provide an easy to use interface, which allow instructors to upload files, organize the files in folders and subfolders, and edit them remotely. According to Barron (2003), an optimal VLS would provide content creation within the program in a WYSIWYG format, and allow the upload of HTML files. Moodle as described in Chapter 3, Table 3.1 has an integrated HTML editor for creating content.

g) System challenges

The 'system challenges' findings were related to the tool functions/features of the respective VLS in use as described in Chapter 3, Table 3.1. The findings of a study examining students' perceptions of feature differences between social media systems and VLS mechanisms, by Egert et al. (2009), indicate a need for VLS to improve user interfaces, user-to-user messaging, notification and awareness mechanisms, thread organization and management, as well as customization systems These findings were confirmed in this study where educators expressed a need for the discussion forums to be modelled around social media systems; notification mechanisms for discussion tools and the ability to customize systems.

6.4.6.4 Importance attached to non-functional characteristics at DUT

Non-functional system characteristics are generic characteristics that can be applied to any class of software. The subtheme and basic themes for Blackboard's non-functional characteristics at DUT are depicted in Table 6.11 together with associated frequency counts illustrating prevalence of the subtheme/basic themes coded/tagged from all the interview transcripts covering the ‘non-functional or quality characteristics needed in a VLS’ interview question category (refer to Appendix 1).

Table 6.11: Perceived importance of non-functional characteristics at DUT

Non-functional system characteristics	10	99
Usability	9	10
Security	5	7
Reliability	8	9
Robustness	6	6
Customisability	7	7
Efficiency	6	6
Flexibility	8	12
Interoperability	8	12
Extensibility	7	7
Standards	10	13
Non Functional system challenges	5	10

The following non-functional system characteristics subtheme deemed to be important in a VLS by educators at DUT were segmented into the following basic themes:

a) Usability

Interview findings indicate that usability is an important non-functional characteristic that should be incorporated into the design of a VLS. Data extracts confirming the importance of the usability characteristic for Blackboard were:; ‘it is easy to learn how to operate the tool mechanically’; ‘should cater for colour blindness’; ‘navigation should be easy and more intuitive’; ‘tools should not be cumbersome to use’; ‘there should be a better flow in the way the environment works’; ‘Blackboard is very user friendly’; ‘there should be tutorial support on how to use the tool with screen capture’.

b) Security

Interviewees viewed security as an important characteristic in a VLS. Data extracts that confirm this view were as follows: ‘students should not be able to view other student’s marks or change marks’; ‘the system should not crash through malicious activity’; ‘Students should not be able to edit another student’s profile’; ‘reasonable level of security when transferring data’; ‘access should be restricted to registered students’; ‘not prone to virus attacks’.

c) Reliability

Interviewees regarded reliability as an important characteristic. Data extracts supporting educators’ views on reliability were: ‘reliable (twenty hours seven days a week availability, lecturers work in off-peak hours setting quizzes'; 'the assignments that is really the most important tool where you have to have security, where you have to have good reliability';' minimise downtime'; 'it is reliable in terms of technology if the Internet is down there is nothing we can do'; 'Sometimes the system just would not work'.

d) Robustness

Interviewees stated that the Blackboard system was robust. Data extracts to this effect were: 'it's robust'; 'it's rare that the software would crash'.

e) Customisability

Interviewees agreed that a VLS should be customisable. Data extracts supporting this viewpoint were: 'the facility to structure and organise your courses'; 'select the tools I want to use';' customise the colour scheme, the layout, and the structure'; 'rearrange items on your interface; 'disable things that are not needed to be viewed '; 'It would be nice if you could arrange things to be wherever you want, like your assessments can be at the bottom'.

f) Efficiency

Efficiency was reported to be an important characteristic of a VLS. Data extracts supporting the need for this characteristic were: **'**Uploading and downloading of assignments should not be time consuming'; 'minimum number of steps to perform tasks'; 'shouldn't freeze when too many people are logged in'.

g) Flexibility

Interviewees expressed the need for flexibility in a VLS. Some of the data extracts verifying this need were: 'access tools directly or access via links'; 'seamless integration of tools rather than being separate entities'; 'open architecture or framework is needed'.

h) Interoperability

Interoperability was viewed as an important characteristic in a VLS. Data extracts verifying this view were: 'importing and exporting data like class lists would be excellent to automatically populate students'; 'Moving material from one online system to another is critical'; 'Interoperability yeah that would be great, linking it to your library system'.

i) Extensibility

Extensibility was regarded as a useful characteristic of a VLS. Data extracts confirming this were: 'extensible so if I see third party tools that I want to integrate with the system I would be able to'; 'used SafeAssign for assignments'.

j) Standards

Interviewees agreed that VLSs should support standards. Data extracts that confirm this finding were: ‘assistive technologies should be supported’;’ ‘In Blackboard there is no built in wiki capability, educators can create external links for wikis but a password is required for each external link created. There should be a standard where you log in once and you can access many different websites’; ‘SCORM compliant’.

k) Non-functional system challenges

The non-functional system challenges raised by educators at DUT were as follows:

- Usability challenges supported by the following data extracts: ‘there’s something that is so rigid about it. I think the navigation of Blackboard is not intuitive’;’ uploading and sharing files in Blackboard is not straightforward as Face book you need to follow a series of steps: select participants, get the URL, open something and then paste URL. Hence it is not used much by students for sharing.
- Reliability challenges were supported by the following data extracts: ‘Server crashes at night’; ‘System is not always available’.
- Customisation challenges were supported by the following data extracts: ‘Blackboard dictates to you so you cannot customize it’; ‘cannot rearrange buttons in Blackboard; you can hide but cannot move things around’.

6.4.6.5 Importance attached to non-functional characteristics at UKZN

The subtheme and basic themes for Moodle’s non-functional characteristics category at UKZN are summarized in Table 6.12 together with associated frequency counts illustrating prevalence of the subthemes/basic themes coded/tagged from all the interview transcripts covering the ‘non-functional or quality characteristics needed for online teaching with a VLS’ interview question category (refer to Appendix 1).

Table 6.12: Perceived importance of non-functional characteristics at UKZN

Non-functional system characteristics	16	157
Usability	15	25
Security	12	23
Reliability	9	11
Robustness	9	11
Customisability	11	15
Efficiency	7	8
Flexibility	10	11
Interoperability	8	16
Extensible	7	7
Standards	13	20
Non Functional challenges	7	10

The following non-functional system characteristics subtheme deemed to be important in a VLS by educators at UKZN were segmented into the following basic themes:

a) Usability

Interview findings indicate that usability is an important non-functional characteristic that should be incorporated into the design of a VLS. Data extracts confirming the importance of the usability characteristic for Moodle were: ‘user interface needs improvement’; ‘the functionality in Moodle is not readily discernable’; ‘should be easy to learn and use; it should be visually appealing’; ‘a system that has this much global scope looks so bland’; ‘navigation can be made more intuitive’; ‘web pages should be clear, and give instructions where necessary’; ‘it would be nice if there was clear help for the students {like tutorial step-by-step guide}’; ‘I want to minimise this thing called cognitive load when using an environment, the design should be similar to familiar applications like Facebook’; ‘journal tool/facility in Moodle is too clunky’.

b) Security

Security was one of the characteristics frequently cited by educators as important in a VLS. Data extracts confirming the importance of this characteristic were: ‘Students should not have access to other students information, it’s all built into Moodle anyway’; ‘security is the big issue students they always ask if other students can see what they have uploaded; they need to be reassured about that’; ‘limit access to registered users’; ‘security tools only registered students should take tests; no one should be able to change marks’; ‘Students should be able to reflect on learning and only teacher should be able to view it’; ‘not prone to virus attacks’; ‘we do not want the system to crash through malicious activity’; ‘Moodle is fairly secure’.

c) Reliability

Reliability was viewed as an important characteristic in a VLS. Data extracts confirming this viewpoint were: 'reliability is a very important issue as you do not the system to be continually down'; 'a report on a weekly basis telling us how much of downtime there was, which is a standard any university offering online programs should have'; 'Stability is very important'; 'twenty four, seven access'.

d) Robustness

Educators agreed that robustness was an important characteristic in a VLS. Data extracts confirming this were: 'mustn't crash often definitely especially when you schedule an online session and students start logging in and the system becomes unavailable'; 'We need the system to work perfectly and solidly'; 'system must be robust'.

e) Customisability

Educators at UKZN viewed customizability as a desirable attribute in Moodle. Data extracts indicate that some staff know how to customize while others have not yet experimented with customisation: 'the colour scheme, the layout, the structure all can be adapted'; 'as a lecturer I want to go and customise it the structure and those sorts of things'; 'Moodle has a facility to be able to change colours and things like that so the students have more ownership of the site they are viewing';' Add colour'; 'always have the two blocks on the side and centre block, it would be great to move this one to the bottom'; 'these are blocks that you can move around as you like up to a point'.

f) Efficiency

Educators agreed that efficiency was an important characteristic in a VLS. Data extracts confirming this were: 'Last year when I used it, it was so slow that when I used to upload documents, it took so long'; 'It was a problem when we were just using our server and if eighty people logged on it just froze, because of the latex commands in between and so on'; 'I want my computer systems to be slick and responsive'; 'it is very efficient'.

g) Flexibility

Interviewee findings indicated that flexibility was an important characteristic of a VLS. Data extracts supporting this finding were: 'yes more integrated with other aspects, integration with the library so it's one place for the students to go to, and integration with Elluminate and Dimdim web-based conferencing'; 'The chat room could be accessed via a web interface or via a mobile'; 'Students that have difficulties with connectivity should be able to choose between a text only website, which gives them the opportunity to complete their assignments, and those that want the fancy bells and whistles using graphic cards and the high end connectivity' ; 'If it's possible to logon to a less heavy site if you are sitting in an area with bad connection and you are going to download these files with colours would need more bandwidth so if there was a feature that would allow people to make a choice between pictures or no pictures, a more basic version that would be more accessible that doesn't require a lot of bandwidth'; 'integration between the VLS and the University's website, which would allow students to read about online new stories and use other website functionality'; 'integration between the library, the publishers and the online modules and free electronic access to articles'.

h) Interoperability

Interviewees regarded interoperability as a needed characteristic in a VLS. Data extracts confirming this need were: 'interoperable with SMS yes for exporting marks'; 'you got interoperability you got the ability to transfer stuff so you don't get locked into platforms'; 'Interoperability is nice when you can bring in cvs files, it can save you time. In our third year we have hundreds of students you don't want to be typing them'.

i) Extensibility

Extensibility was viewed as a desirable feature in a VLS. Data extracts confirming this view were: 'With Moodle its open-source there's all the other things that you can add'; 'There are thousands of plug-ins and we use quite a few of them'; 'you could bring in widgets plug in, there could be a library plug in so you could do research'. As the VLS currently in use is open source software, it could be very easily changed, new functionality added and adapted in any way required provided subject to University approval as it a University wide VLS. Educators welcomed the integration of Turnitin into Moodle to check and report on plagiarism in students' assignments.

j) Standards

Interviewees agreed that VLSs should support standards. Data extracts confirming this finding were: 'SCORM compliancy was regarded as vital as VLSs change over time and if you migrate to a new one you would not want to lose all the material you created'; 'students also had to develop some outside packages outside of Moodle and load it up using the SCORM function'; 'Accessibility standards are very important'; 'If there are standards and people just embrace them more like open id, which allows you to open into multiple environments'; 'should be a standard where you download a course and upload it to another one'. Whilst not all educators had students with visual and other impairments in their courses, they stated the need for the system to conform to accessibility standards to allow these students enjoy the same learning opportunities as other students.

k) Non-functional system challenges

The non-functional system challenges reported by interviewees at UKZN were as follows:

- Usability challenges supported by the following data extracts: 'there is an enormous amount in Moodle that is not self-evident. People have to go and learn by themselves and very few people want to do that'; 'the functionality in Moodle is not discernable'; 'you would have to experiment'; 'it is difficult to know where the different things are'; 'a system such as Moodle that has a global following looks so bland'.
- Reliability challenges supported by the following data extract: 'system is sometimes not available over weekends'.

6.4.6.6 Analysis of non-functional characteristics deemed important at DUT and UKZN

Al-Busaidi and Al-Shihi (2010) cited system characteristics that were found to be significant on e-learning acceptance and use, namely, reliability, accessibility and system's functionality, interactivity, and response. In addition, there was general agreement that a VLS design should demonstrate all the non-functional system characteristics. The findings of this study confirmed the theory on required system non-functional characteristics (Wyles, 2004b; Neal & Miller, 2005; Wan et al., 2005; Kritikou & Demestichas, 2008; Robbins, 2002). The importance of interoperability standards and modular, extendable architectures was emphasized for providing the desired flexibility in a technology environment that is fast evolving (Wyles, 2004b). One of the criteria/requirements identified for evaluating open-source VLSs with the aim of selecting an open-source system was usability (Wyles, 2004b). System must contain robust security and encryption mechanisms to protect content and user data. Security measures usually include passwords and encryption (Elementk, 2003). The technical dimension must also provide support for issues of access, control, security, to make sure that information is secure, accessible and accurate (Egert et al., 2009). The findings with regards to reliability confirmed the need for little or no disruption/downtime as advocated by Horton and Horton (2003). The need to customise the interface as expressed by educators in this research, confirm the findings of the study conducted by (Egert et al., 2009) who reported that students wanted to configure their VLSs, The findings with regards to efficient response time performance, reiterates the need for the efficiency attribute to be incorporated into a VLS as stated by Kalinga (2008).

The non-functional challenges experienced were related to the respective VLSs, namely, Blackboard and Moodle as described in Chapter 3, Table 3.2. In a multi-attribute decision support model for VLS evaluation done by Arh and Blazic (2007), the navigation criteria for ease of use attribute scored average for Blackboard version 6 and high for Moodle version 1.5.2. The navigation problem experienced in Blackboard was confirmed in this study.

The subthemes were interrelated as the VLS non-functional system characteristic subtheme was related to the subtheme of VLS functions/features deemed useful.

6.4.7 Content category/theme F: Organisational

Content category or theme F represents the organisational theme in particular institutional e-learning support and challenges. This theme and subthemes are depicted in Tables 6.13 and 6.14 together with associated frequency counts illustrating prevalence of the subthemes coded/tagged from all the interview transcripts separated by case, covering the institutional e-learning capabilities/support interview question category (refer to Appendix 1). The organisational theme and subthemes address research sub-question 4 listed in Chapter 1, section 1.4. This theme is important in that the role of organisational support services in which the system is embedded and perceived challenges need to be understood in relation to VLS usage behaviour in residential institutions of higher education.

6.4.7.1 DUT organisational theme

The count of individual occurrences of the subthemes within DUT organisational category/theme is summarized in Table 6.13, which is more or less equitably distributed. The results/outcomes for each of the subthemes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.13: DUT organisational theme

Organising theme	Subthemes	Sources	References
Organisational		10	99
	Institutional support for e-learning	10	50
	Organisational (institutional) Challenges	10	49

a) Institutional support for e-learning

The subtheme institutional support for e-learning subtheme comprises the following basic themes:

- **Organisational and technical support** substantiated by the following data extracts: 'Core institutional support, technical assistance'; 'technical support'; 'ICT support'; 'direct help line'; 'point user support - I drive e-learning within my school'; 'support in terms of collaboration between the different units'.

- **Instructional design and development support** substantiated by the following data extracts: ' Training'; 'short focused workshops on specific tools'; 'short training sessions'; 'training geared toward using specific tools'; 'Professional training to understand the pedagogic, the functionality, to adapt the teaching approach'; 'basic and advanced training'; **'**having a support group' ;'short workshops so you can learn what you want to learn'; 'Design support and training'; 'instructional designers'; 'Instructional design is supported in the training'; 'Faculty can expose people to more possibilities and to assist as we do not have the time to learn it on our own'; 'showcase online classrooms'.

- **Physical Resources** supported by the following data extracts: **'**hot spots Wifi areas'; 'provide students with laptops to give all the students the same opportunities of online classes'; 'resources to support people'; 'more open access labs'; 'more computers that are in good working condition'; 'more bandwidth for faster speeds'.

- **Management support** substantiated by the following data extracts: 'policy that guides as people do not like to be regulated'; 'policy or guideline that guides and supports'; 'DUT should a policy to keep LABs current'; 'policy standards a framework for online teaching and learning'.

b) Organisational challenges

The organisational challenges subtheme reported by educators at DUT comprises the following basic themes:

- **Training issues** supported by the following data extracts:' The upgrading of your training is definitely missing'; 'There is a whiteboard option in Blackboard but I couldn't get it to work';' I have to understand how to use the grade book'; 'I think that's where the support is lacking. I had to teach myself on how to make a link to the glossary, how to pull all the various components together'; 'I am having a problem with my assessments'.

- **Technology infrastructure** supported by the following data extracts: 'Server is down'; 'software technical issues when using different operating systems'; 'computers are at different stages of collapse'; 'Small departments at DUT do not have a dedicated LAN'; 'you cannot upload videos for the students because of bandwidth';' 'bandwidth is a major issue'; 'the University has grown so big, so quickly I don't think there's many open access labs'; 'some of the computers don't work'; 'There is inadequate technical support in those labs and they are riddled with viruses';' dedicated teaching labs taken away'; 'I would love to be able to do some sort of assessments online but there are not enough computers to do so'; ' I think that upper management has no idea or no interest in e-learning at all. On the one hand they say they serious about e learning, on the other hand they just don't support it from a resource point of view'.

- **Organisational challenges** supported by the following data extracts: **'**Setting up online courses and uploading class lists of registered students is done centrally. Creates time delays when students are not added to online course'; 'e-learning is almost like a sub-culture and it never becomes a mainstream thing';' 'user registration is the one thing we have a lot of problems with, sometimes students can get on and at other times they can't and that is very frustrating';**'** little collaboration between the various units at DUT'; 'System not integrated with university system'; 'lack of communication forum to report system design issues'; 'Designers of Blackboard should be aware of things that are not working out the way they were planned to work out'.

6.4.7.2 UKZN organisational theme

The count of individual occurrences of the subthemes within UKZN organisational category/theme is summarized in Table 6.14 and shows the count of individual occurrences for the subtheme 'institutional support for e-learning' is higher than the subtheme 'organisational challenges'. The results/ outcomes for each of the subthemes are described below. Selected data extracts were included in the description to demonstrate prevalence of subthemes and basic themes.

Table 6.14: UKZN organisational theme

Organising theme	Subthemes	Sources	References
Organisational		16	121
	Institutional support for e-learning	16	70
	Organisational (institutional) challenges	14	51

a) Instructional support for e-learning

The subtheme institutional support for e-learning comprises the following basic themes:

- **Organisational and technical support** substantiated by the following data extracts: **'**ICT call centre support for students and staff' ; 'attentive and sympathetic user support who can work very closely with the teacher and listen to what that person is trying to achieve and then help them'; 'point person (somebody who is in the forefront of any activity or endeavour) within the school to support other staff'; 'log problems and issues; have forums to discuss issues as they come up'; ''change management structure put into place, mange this change, show them the benefits of something and help them through the process of changing into this new process'; 'the most powerful for me is when people using Moodle show others what they are doing, this can create a snowball effect. People say if you can do it I can do it'; 'provide them with a support mechanism that gets them to where they want to be'. 'if someone could sit with you and help you'; 'It would be nice if you had someone with the technical knowledge to come up and set it up in the most efficient way, instead of wasting hours experimenting'; 'The university should have a e-learning department and show lecturers that are keen how Moodle could be useful to them, show them what they can do with it' 'personal one on one support was regarded as useful'; 'Help desk support'; 'the most important is the technical assistance'.

- **Instructional design and development support** substantiated by the following data extracts: **'**there has to be some orientation courses, some specific training of staff'; 'Specialised training'; 'hands on training on specific aspects'; 'More advanced training'; 'Need for training with the various system tools'; 'Orientation and workshop sessions are important for academic staff that have not used Moodle before because it is not intuitive to use, you need to have an understanding of how it works'; 'Need training courses with theory behind online learning, pedagogy and technical learning'; 'One-on-one training'; 'There is a need for people to be made aware of all features, how they can use it'; 'they need to offer some kind of professional training, teaching or something'; 'Workshops and professional training are helpful'; 'Training with conceptualisation (theory)'; 'What I would like is an instructional designer working with lecturers in a faculty. Very versed not only in online learning environments but can get the pedagogical knowledge required within the field and work with a faculty'; 'allows us to design modules and content; instructional support'; 'go through your course and give you some insights on how to do things differently'; **'**showcase best practices'; 'teaching and learning conferences there should maybe have a dedicated section on Moodle and innovative practices in Moodle'; experimental Moodle site at UKZN where staff can learn and experiment with the various tools before going live'; 'you really need somebody in the university who really knows how to set up courses and train the users'; 'They should have a workshop, where lecturers can put their course together during the workshop'.

- **Physical Resources** supported by the following data extracts: **'**roll out of laptops for students'; 'Wi-Fi hot spot'; 'distribution of more computers in the residences'; 'Wireless in some places like the residences'; 'Resources are important especially the hardware. I think the number of computers is important because some of our students don't have access to computers and when they go to the LAN, its full or locked and we expect them to do a quiz'.

- **Management support** substantiated by the following data extracts: **'**policy for large undergraduate courses to be delivered online'; 'No policy as soon as it becomes regulated people may not want to do it'; 'the longer-serving lecturers might find the transition difficult'; 'The policy of the university is to use more e-learning strategy; need to state the learning reasons for it'; 'Whenever you regulate you are forcing people'.

b) Organisational challenges

The organisational challenges subtheme reported by educators at UKZN comprises the following basic themes:

- **Training issues** supported by the following data extracts: ‘The problem is that we haven’t had any training with Moodle yet’; ‘Importing test questions that would be fabulous I am not sure how to do it’; ‘I don’t know all of Moodle’s functions and that’s part of the problem’; ‘I can’t get examples of usage of Moodle from other people’; ‘staff that just started using Moodle were not aware of the settings’.

- **Infrastructure challenges** supported by the following data extracts: ‘firewalls and proxies are a limiting factor when you want to teach outside the university’; ‘University Moodle has file size upload limits’; ‘no open consultation’; ‘The LAN facilities are not enough to accommodate the class’; ‘every student should have a laptop’; ‘You Tube is being blocked by our systems at UKZN because of bandwidth problem’; ‘They need to feel like when they walk into the LAN, there’s going to be a computer. I understand the students frustration’; ‘Competing for computers in LAN is horrific’; ‘Should be able to access the learning system wirelessly’ ; ‘there is no sever or system within IT that is monitoring external forces that might be causing breakdowns to the system so say Telkom line is down they don’t register that so they don’t know system is down and cannot be accessed from outside the university’; ‘Access to computers was of foremost concern as students were unable to do the quizzes because the LAN was locked or the LANs are full’.

- **Organisational challenges** supported by the following data extracts: ‘the other issue I find difficulty with Moodle is the lack of synchronisation between the library, the publishers and the online modules’; ‘It is a change management process so for most change management process there are people that are keen like me, and there are people that are totally resisting at the other end’; ‘What’s frustrating in our system currently is the copyright process. The issue of getting copyright for all the materials on Moodle is problematic because of the way our University currently manages its copyright process because you have to apply using a paper form for every article you use for copyright and that gets sent off’; ‘material we are developing in Moodle we have no creative content licensing attached to it and I think we should be attaching creative content licensing to our material in Moodle’; ‘issues of who does the material belong to; who does the learning materials belong in terms of IP; quality control over the material; meta data attached to it; creative contents licensing’; ‘no links to live streaming of events such as conference and other talks within Moodle’.

6.4.7.3 Analysis of the organisational theme for DUT and UKZN

This research supports the findings of a study conducted by Al-Busaidi and Al-Shihi (2010) who reported the influence of organisational factors on the use of technology in teaching and categorized these factors into the following classes: motivators/de-motivators, training, technology alignment, organization support and technical support.

At DUT, the count of individual occurrences for the two subthemes was split more or less equally. At DUT, most of the educators were using Blackboard for several years and had encountered several organisational challenges, which needed to be addressed by the appropriate institutional support mechanisms. At UKZN, the count of individual occurrences for institutional support was higher than for organisational challenges. A possible explanation is that Moodle was new to most educators at UKZN as it was rolled out in the previous year, replacing the OLS system. Educators spoke at length on the institutional support that was needed for e-learning to fully exploit the functions/features of the system. It was conceivable that they had not encountered as many organisational challenges as they were using mostly the content delivery functions of the system.

In both institutions, the basic themes associated with the subtheme 'institutional support for e-learning' were the same, namely, training and workshops, policy and guidelines, physical resources and user support. At DUT, all the educators interviewed had completed the basic 'Pioneers' training programme, which included instructional design. Some of them had completed the intermediate and advanced training programmes. The DUT staff members were exposed to the pedagogy behind the use of technology in teaching and learning. UKZN, on the other hand, did not have any formal training programmes. However, workshops were conducted with the various faculties to orientate staff to Moodle when the university switched to this new VLS. Support for this system was provided by staff in the academic computing department, and a link to an online textbook on Moodle was posted on the learning site. However, at UKZN there were other departmentally controlled installations of Moodle that had their own technical support for the system. DUT educators were requesting upgrading of their training, and training in the use of specific tools whereas UKZN educators expressed the need for training with pedagogy, workshops, basic and advanced training, and an e-learning unit among others.

The finding of this study supported the findings of Al-Busaidi and Al-Shihi (2010); Morgan (2003); Britain and Liber (2004); Mcgee and Green (2008); Vovides et al.(2007) and Nanayakkara (2007) with regards to organisational and technical support, as well as instructional design support discussed in Chapter 4, section 4.3.2.

The two institutions expressed a similar view that guidelines are the more preferable strategy over policies, which tend to regulate.

Educators at DUT and UKZN cited computer provisioning, wireless connectivity and bandwidth as physical resources needed for e-learning. Technical support, technical assistance and ICT were the main types of user support required by educators at DUT. UKZN, on the other hand, suggested a whole host of user support mechanisms ranging from technical support to the support of power users and point persons within schools, to change management support. According to Beck (2005), as discussed in Chapter 4, section 4.3.2 a substantive infrastructure is needed to make a VLS a functioning tool.

The subtheme of ‘organisational challenges’ comprises three basic themes for both institutions, namely, training issues, infrastructure challenges and organisational challenges. The training issues at UKZN centred on lack of awareness of the various functions/features of Moodle while DUT was faced with challenges of upgrading training and issues with the use of certain tools. Organisational challenges faced at DUT were around registration, lack of co-ordination between various department and system design feedback. Organisational challenges faced at UKZN were lack of co-ordination between internal department and external parties, change management issues and copyright issues. Technological infrastructure challenges at DUT were mainly focused on lack of physical facilities and computer maintenance issues to integrate e-learning. At UKZN, a wider range of issues were mentioned from inadequate LAN provisioning, which was countered by others stating that we have fantastic resources, to blocking of social networking sites, to upload limits to monitoring outside access. While the basic themes were the same for the two institutions, the extent and intensity of these challenges experienced was different, as evidenced by the data extracts.

These findings supported those of Attewell (1992), who made the observation that a lot of knowledge and technical know-how become important barriers to diffusion. (Dutton et al., 2004) noted another challenge that could impact on the success of e-learning, namely, expectations about the number of hours instructors meet with students are enshrined in rules and norms of universities.

6.5 Analysis of overall findings

The pedagogic features subtheme in the pedagogic category/theme was related to the VLS functions deemed useful theme in terms of the instructional functions that the system provides for online teaching and learning. The characteristics of online teaching subtheme were closely linked to the pedagogic features subtheme within the same pedagogic category/theme, as well as the functions/ features provided by the system manifest in the VLS functions deemed useful theme. The organisational theme was linked to the VLS functions deemed useful theme, in terms of the infrastructure and training support needed for a VLS to function optimally in this first place and for the uptake of the system by educators and students. The organisational theme was also related to the pedagogic features subtheme of the pedagogic theme as the educators need to be trained in the pedagogic approaches of teaching with technology. The user difference theme was linked to actual system usage in so far as individual characteristics, beliefs and perceptions can be both an enabling as well as an inhibiting aspect in actual system usage. The relationship between the demographic themes such as the length of usage and number of online/hybrid courses taught and actual system usage behaviour stem from the fact that over time educators move from an exploratory/experimental phase of usage into more established usage behaviours and the more advanced features of the system are used.

6.5.1 DUT Cluster Analysis

Table 6.15 presents the DUT findings of a cluster analysis of the following themes: organisational theme, VLS functions deemed useful, system experience, pedagogic, user difference theme and actual system usage based on word similarity. Cluster analysis is an exploratory technique that can be used to visualize patterns in a project by grouping sources or nodes that share similar words, similar attribute values, or are coded similarly by nodes. Cluster analysis diagrams offer a graphical representation of sources or nodes to make it easy to see similarities and differences. Sources or nodes in the cluster analysis diagram that appear close together are more similar than those that are far apart. In this case, nodes representing content categories or themes were compared based on similarity of words ("NVivo 10 research software for analysis and insight," n.d.).

In Tables 6.15 and 6.16, each possible pair of content categories (themes) is listed as a row in the table and is compared. A similarity index displays a value that indicates the degree of similarity for each pair of themes based on the similarity metric selected, which in this instance, is the Pearson correlation coefficient.

Table 6.15: DUT cluster analysis summary

Node A	Node B	Pearson correlation coefficient
Nodes\\DUT\\System functions and characteristics theme	Nodes\\DUT\\Pedagogic theme	0.949386
Nodes\\DUT\\Actual system usage theme	Nodes\\DUT\\System functions and characteristics theme	0.93392
Nodes\\DUT\\Actual system usage theme	Nodes\\DUT\\Pedagogic theme	0.886623
Nodes\\DUT\\System functions and characteristics theme	Nodes\\DUT\\Organisational theme	0.867815
Nodes\\DUT\\Pedagogic theme	Nodes\\DUT\\Organisational theme	0.865342
Nodes\\DUT\\User difference theme	Nodes\\DUT\\Pedagogic theme	0.842994
Nodes\\DUT\\User difference theme	Nodes\\DUT\\System functions and characteristics theme	0.84002
Nodes\\DUT\\User difference theme	Nodes\\DUT\\Organisational theme	0.815491
Nodes\\DUT\\Actual system usage theme	Nodes\\DUT\\Organisational theme	0.77239
Nodes\\DUT\\Actual system usage theme	Nodes\\DUT\\User difference theme	0.756822
Nodes\\DUT\\Actual system usage theme	Nodes\\DUT\\System experience theme	0.455138
Nodes\\DUT\\System functions and characteristics theme	Nodes\\DUT\\System experience theme	0.441833
Nodes\\DUT\\System experience theme	Nodes\\DUT\\Pedagogic theme	0.407844
Nodes\\DUT\\System experience theme	Nodes\\DUT\\Organisational theme	0.37625
Nodes\\DUT\\User difference theme	Nodes\\DUT\\System experience theme	0.345754

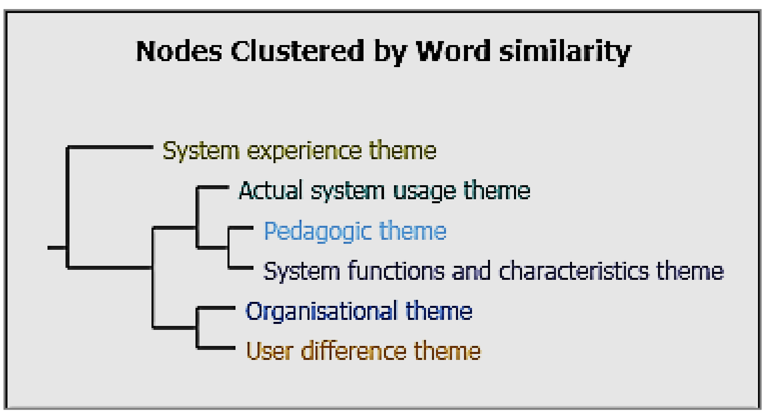

Figure 6.1: Cluster analysis diagram for DUT content categories or themes

From the Pearson correlation coefficient values listed in Table 6.15 and the cluster analysis diagram in Figure 6.1, one can see that there is a strong correlation between:

- Actual system usage (e.g. communication, content, administration and assessment features) and virtual learning systems functions deemed useful (e.g. course communication and collaboration, course administration, content delivery and management, and online assessment).
- Actual system usage (system features used) and pedagogic theme (e.g. pedagogic approaches used; learning strategies).

- Actual system usage and organisational theme (e.g. ‘organisational challenges’ - training issues).
- Actual system usage and user difference theme (e.g. user difference challenges: changing mind-set; reluctance).
- Pedagogic theme (e.g. pedagogic challenge: uptake of discussion forums) and virtual learning systems functions deemed useful (e.g. usage of discussion forums).
- Pedagogic theme and organisational theme (e.g. professional training in pedagogy)
- Virtual learning systems functions deemed useful and organisational theme (e.g. system training issues).
- User difference theme (e.g. teaching style preference, computer comfort level) and pedagogic theme.
- User difference theme (e.g. teaching style preference) and virtual learning systems functions deemed useful.
- User difference theme (e.g. user experience of online teaching) and organisational theme (e.g. provision of resources or lack thereof for online teaching).

And a medium correlation between:

- Actual system usage and system experience (e.g. length of VLS usage measured in number of years and number of online/hybrid courses taught).
- System experience (e.g. length of VLS usage measured in number of years) and system functions deemed useful.
- Pedagogic theme (e.g. pedagogic approaches) and system experience.
- System experience and organisational theme (e.g. organisational support for e-learning).
- User difference theme (e.g. teaching style; challenges) and system experience.

6.5.2 UKZN Cluster Analysis

Table 6.16 presents the UKZN findings of a cluster analysis of the organisational theme, VLS functions deemed useful, system experience, pedagogic theme, user difference theme and actual system usage based on word similarity.

Table 6.16: UKZN Cluster analysis summary

Node A	Node B	Pearson correlation coefficient
Nodes\\UKZN\\System functions and characteristics theme	Nodes\\UKZN\\Pedagogic theme	0.937893
Nodes\\UKZN\\System functions and characteristics theme	Nodes\\UKZN\\Organisational theme	0.903443
Nodes\\UKZN\\Pedagogic theme	Nodes\\UKZN\\Organisational theme	0.897495
Nodes\\UKZN\\System functions and characteristics theme	Nodes\\UKZN\\Actual system usage theme	0.87971
Nodes\\UKZN\\User difference theme	Nodes\\UKZN\\System functions and characteristics theme	0.831946
Nodes\\UKZN\\User difference theme	Nodes\\UKZN\\Organisational theme	0.824828
Nodes\\UKZN\\User difference theme	Nodes\\UKZN\\Pedagogic theme	0.80863
Nodes\\UKZN\\Pedagogic theme	Nodes\\UKZN\\Actual system usage theme	0.790491
Nodes\\UKZN\\User difference theme	Nodes\\UKZN\\Actual system usage theme	0.761057
Nodes\\UKZN\\Organisational theme	Nodes\\UKZN\\Actual system usage theme	0.759846
Nodes\\UKZN\\System experience theme	Nodes\\UKZN\\Actual system usage theme	0.3812
Nodes\\UKZN\\User difference theme	Nodes\\UKZN\\System experience theme	0.350051
Nodes\\UKZN\\System functions and characteristics theme	Nodes\\UKZN\\System experience theme	0.335233
Nodes\\UKZN\\System experience theme	Nodes\\UKZN\\Pedagogic theme	0.286895
Nodes\\UKZN\\System experience theme	Nodes\\UKZN\\Organisational theme	0.275096

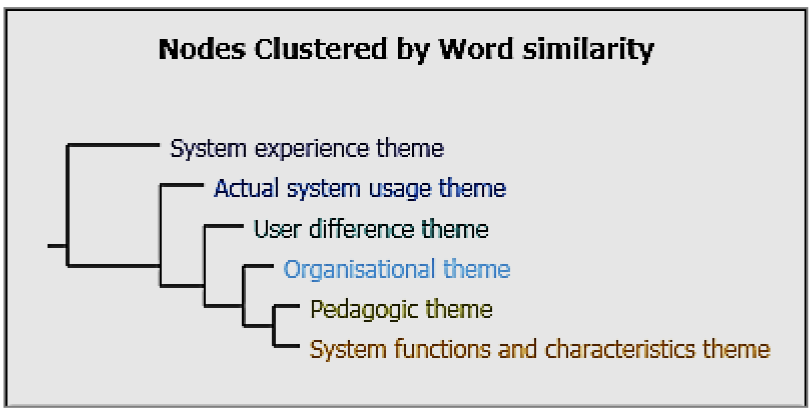

Figure 6.2: Cluster analysis diagram for UKZN content categories or themes

From the Pearson correlation coefficient values listed in Table 6.16 and the cluster analysis diagram in Figure 6.2, one can see that there is a strong correlation between:

- Actual system usage (system features used) and virtual learning systems functions deemed useful (e.g. course communication and collaboration, course administration, content delivery and management, and online assessment).
- Actual system usage (e.g. system features used) and pedagogic theme (e.g. teaching and learning strategies).

- Actual system usage (e.g. online assessment) and organisational theme (e.g. challenges: availability of computers).
- Actual system usage and user difference theme (e.g. experience of online teaching - lack of time; change in mind-set)
- Pedagogic theme (e.g. posting in forums and online assessment) and virtual learning systems functions deemed useful (e.g. forum posting; online marking and grading).
- Pedagogic theme (e.g. characteristics of online teaching) and organisational theme (e.g. institutional support for e-learning)
- Virtual learning systems functions deemed useful (e.g. course administration - registration features) and organisational theme (e.g. organisational control of registration).
- User difference theme (e.g. experience of online teaching - effectiveness of delivery) and pedagogic theme (e.g. teaching approaches).
- User difference theme (e.g. teaching style preference; computer comfort level) and virtual learning systems functions deemed useful.
- User difference theme (e.g. user experience of online teaching) and organisational theme (e.g. organisational support for e-learning).

And a medium correlation between:

- Actual system usage and system experience.
- System experience (e.g. length of VLS usage measured in number of years) and VLS functions deemed useful.
- User difference theme (e.g. teaching style; challenges) and system experience.

And a low correlation between:

- Pedagogic theme (e.g. teaching approaches and learning strategies) and system experience theme.
- System experience and organisational theme (e.g. organisational support for e-learning).

6.5.3 Thematic map of themes and subthemes for DUT and UKZN

According to Attride-Stirling (2001), thematic networks standardise the drawing out of: (i) lowest-order principles evident in the text (Basic Themes); (ii) categories of basic themes grouped together to summarize more abstract principles (Organizing Themes); and (iii) super-ordinate themes summarising the principal metaphors in the text as a whole (Global Themes). These are then represented as web-like maps depicting the relevant themes at each of the three levels, and showing the relationships between them. In this study, however, organizing themes were further segmented into subthemes. Categories of basic themes grouped together to form subthemes were not depicted in the thematic map for purposes of readability and comprehension. These basic themes were, however identified and described in sub-sections 6.4.3, 6.4.4, 6.4.5, 6.4.6, and 6.4.7.

Figure 6.3 depicts a thematic map with six themes, one of which is a global theme, and four out of five were organizing themes, which were further segmented into subthemes. The global theme is actual system usage and the five themes were virtual learning systems deemed useful, pedagogic theme, organisational theme, user difference theme and system experience. System functions and characteristics deemed useful is an organizing theme made up of the following subthemes: assessment, administration, content creation and management, communication, student productivity and involvement, student tracking, system challenges, and non-functional system characteristics. The pedagogic theme is the second organizing theme made up of the following subthemes: pedagogic features, characteristics of online teaching, and challenges. The organisational theme is the third organizing theme made up of the following subthemes: institutional e-learning capability or support and challenges. User difference theme is the fourth organising theme made up of the following subthemes: computer comfort level or experience, teaching style or preference, experience of online teaching and challenges. The thematic map is a reflection of the meaning manifested in the data set as a whole including DUT and UKZN. This thematic map representation is aligned to the theoretical approach and framework used and shows the relationships between the themes. The themes were related to the main research question ‘What are the components of a conceptual model that represents the influence of factors on VLS usage in South African institutions of higher education?’ All the organising themes, namely, system, pedagogic, organisational and user difference were strongly related to the global theme of actual system usage in higher education and to one another. One of the themes, namely, system experience has a medium or low correlation with the global theme and with the other four organising themes. This result is significant as the results of the interview analysis confirm the research sub-questions listed in Chapter 1, section 1.4, and the research propositions outlined in Chapter 4, section 4.5.

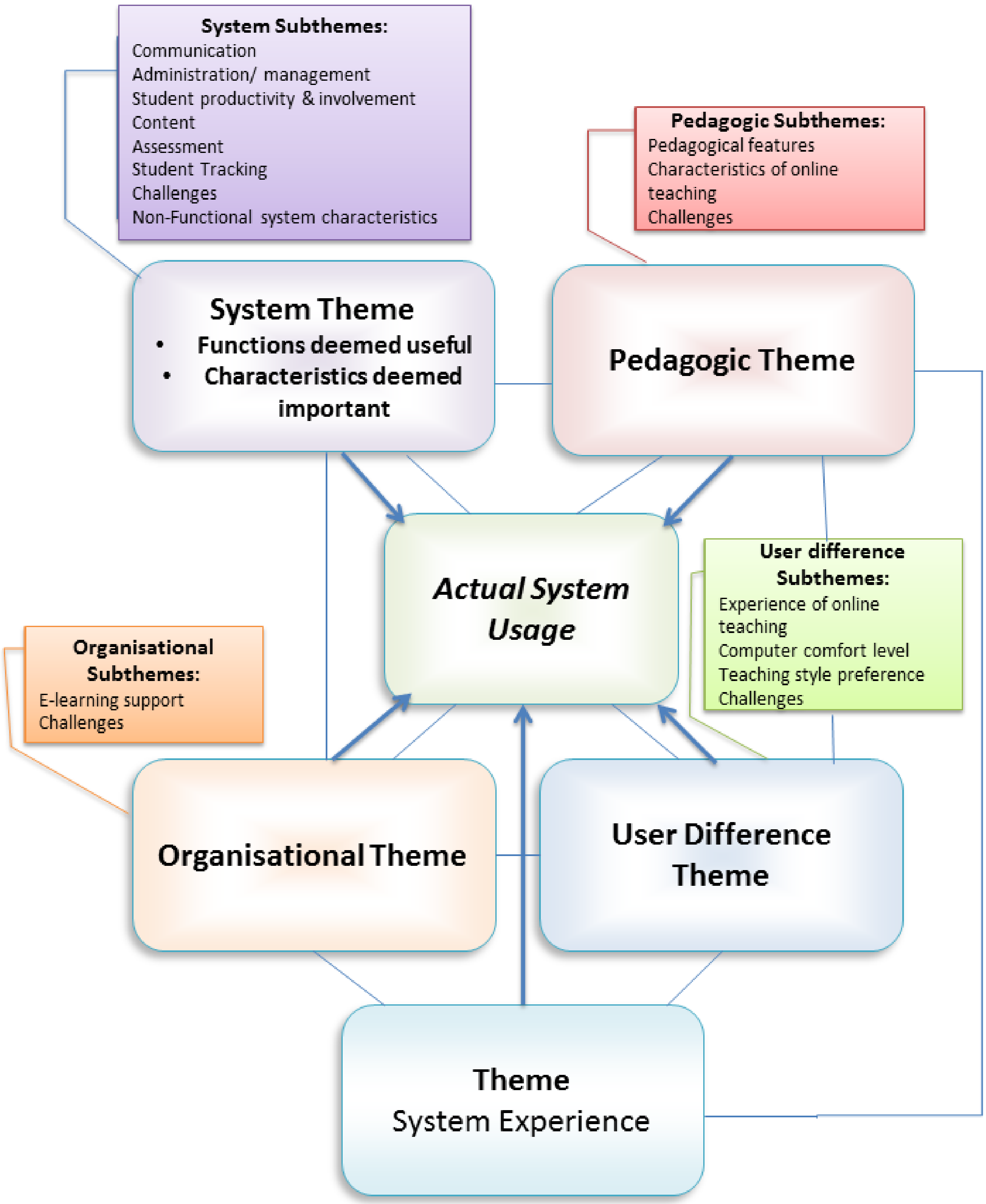

Figure 6.3: Thematic map showing themes and subthemes

6.6 Summary

This chapter presented the results and analysis of the data collected from the interviews conducted at DUT and UKZN. The contents of this chapter included aspects such as approach for data collection and analysis of case study data, interviewee profile information, results of thematic and cluster analysis. A confirmatory approach to qualitative data analysis was undertaken where specific codes or analytic categories were predetermined and where codes were generated from research propositions discussed in Chapter 5 (Guest, MacQueen & Namey, 2012). The results of the thematic and cluster analysis confirm that each theme is linked to the main research question and the initial theoretical framework produced from the literature study (see Chapters 2, 3 and 4) and presented in Chapter 4, section 4.5. The results of the qualitative study also uncovered an additional theme, namely, system experience, and additional subthemes for the organizing themes depicted in Figure 6.3. Basic themes grouped under subthemes were also identified and were described under the relevant subsections describing the various themes. The initial theoretical framework was adapted in accordance with the results of the thematic and cluster analysis presented in this chapter. The research questions and the survey instrument were also refined accordingly based on the adapted theoretical framework and thematic results from this chapter. The results of the survey administered at DUT and UKZN are presented in Chapter 7 and serve as a confirmation of the results produced in this chapter. In Chapter 7, a factor analysis is performed on survey data to identify the factors that influence VLS usage in higher education. The joint outcomes and results from this chapter, namely, themes and subthemes, and factors identified in Chapter 7 will serve as the basis for the composition of the conceptual model, which will be discussed in Chapter 8. In addition, the outcomes from this chapter will be used to discuss the contributions of the study in Chapter 10.

CHAPTER 7: SURVEY FINDINGS AND QUANTITATIVE ANALYSIS

7.1 Introduction

This chapter describes the findings and analysis of the data obtained from the structured survey administered at DUT and UKZN. Chapter 6 identified themes and subthemes relevant to the usage of VLSs. In this chapter, a factor analysis is undertaken and factors relevant to the usage of VLSs are identified. The quantitative data obtained from the survey was statistically analysed using SPSS version 17.

The demographic results are presented in section 7.2 followed by the analysis of actual system usage in section 7.3. Sections 7.4 and 7.5 provide a description of the theoretical framework constructs used for the study and the statistical analysis of the theoretical framework constructs, respectively. Section 7.6 provides a description of the correlation between usage clusters and theoretical framework constructs. Section 7.7 describes the correlation between actual system usage and the demographic factors. Section 7.8 describes the correlation between actual system usage and the various factors. Section 7.9 describes the correlation between actual system usage and constructs of the various factors. Section 7.10 describes the correlations between constructs of the different factors. Section 7.11 describes the correlation between demographic and theoretical factors. Section 7.12 presents a discussion of the findings and analysis in relation to the research questions followed by the chapter summary in section 7.13.

7.2 Demographic Results

7.2.1 Institution DUT

7.2.1.1 Academic rank

The majority of the respondents were lecturers and senior lecturers, followed by academic ranks ‘other’ and associate professor, who collectively made up a small percentage of the respondents, as illustrated in Table 7.1.

Table 7.1: Academic rank

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lecturer	16	44.4	44.4	44.4
	Senior Lecturer	12	33.3	33.3	77.8
	Associate Professor	2	5.6	5.6	83.3
	Other	6	16.7	16.7	100.0
	Total	36	100.0	100.0	

7.2.1.2 Academic level of study taught

Table 7.2 provides a summary of the academic levels taught with the highest frequency of undergraduate courses, followed by mostly undergraduate with some postgraduate; then postgraduate courses only; and lastly, mostly postgraduate and some undergraduate.

Table 7.2: What level (s) of study do you lecture?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate courses only	17	47.2	47.2	47.2
	Postgraduate courses only	5	13.9	13.9	61.1
	Mostly undergraduate with some postgraduate	11	30.6	30.6	91.7
	Mostly postgraduate with some undergraduate	3	8.3	8.3	100.0
	Total	36	100.0	100.0	

7.2.1.3 Name of VLS currently/most currently used

Table 7.3 is a summary of the current virtual learning systems used with Blackboard being the most used, followed by Moodle, WebCT and the other category.

Table 7.3: Name of VLS currently/most currently used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WebCT	4	11.1	11.1	11.1
	Moodle	8	22.2	22.2	33.3
	Blackboard	22	61.1	61.1	94.4
	Other	2	5.6	5.6	100.0
	Total	36	100.0	100.0	

7.2.1.4 Length of usage of VLS

Table 7.4 shows that the highest frequency of length of usage is 'from 1 to less than 3 years'; followed by a tie between 'less than 1 year' and 5 years or more'; and the lowest frequency of length of usage is 'from 3 to less than 5 years'.

Table 7.4: How long have you been using the VLS?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	7	19.4	19.4	19.4
	from 1 to less than 3 years	17	47.2	47.2	66.7
	from 3 to less than 5 years	5	13.9	13.9	80.6
	5 years or more	7	19.4	19.4	100.0
	Total	36	100.0	100.0	

7.2.1.5 Total number of distinct online/hybrid courses taught

The highest frequency for number of distinct online/hybrid courses taught, depicted in Table 7.5, is 'between 1 and 3', followed by 'greater than 6' and then 'between 4 and 6'.

Table 7.5: Total number of distinct online/hybrid courses taught in your career:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	between 1 and 3	24	66.7	68.6	68.6
	between 4 and 6	5	13.9	14.3	82.9
	greater than 6	6	16.7	17.1	100.0
	Total	35	97.2	100.0	
Missing	System	1	2.8		
Total		36	100.0		

7.2.2 Institution UKZN

7.2.2.1 Academic rank

The majority of the respondents were lecturers followed by academic ranks 'other', senior lecturer, associate professor, and professor, as illustrated in Table 7.6.

Table 7.6: Academic rank

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lecturer	33	45.8	45.8	45.8
	Senior Lecturer	13	18.1	18.1	63.9
	Associate Professor	8	11.1	11.1	75.0
	Professor	4	5.6	5.6	80.6
	Other	14	19.4	19.4	100.0

7.2.2.2 Level of study taught

Table 7.7 provides a summary of the academic levels taught with the highest frequency of mostly undergraduate with some postgraduate, followed by undergraduate courses only, mostly postgraduate with some undergraduate, and lastly, postgraduate courses only.

Table 7.7: What level (s) of study do you lecture?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate courses only	21	29.2	30.0	30.0
	Postgraduate courses only	4	5.6	5.7	35.7
	Mostly undergraduate with some postgraduate	33	45.8	47.1	82.9
	Mostly postgraduate with some undergraduate	12	16.7	17.1	100.0
	Total	70	97.2	100.0	
Missing	System	2	2.8		
Total		72	100.0		

7.2.2.3 Name of VLS currently/most currently used

Table 7.8 is a summary of the current virtual learning systems used with Moodle being the most used, followed by the other category, and then Blackboard and OLS in third place.

Table 7.8: Name of VLS currently being used/ most recently used for your course (s)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	OLS	2	2.8	2.8	2.8
	Moodle	65	90.3	90.3	93.1
	Blackboard	2	2.8	2.8	95.8
	Other	3	4.2	4.2	100.0
	Total	72	100.0	100.0	

7.2.2.4 Length of usage of VLS

Table 7.9 shows that the highest frequency of length of usage is 'from 1 to less than 3 years'; followed by 'from 3 to less than 5 years', then '5 years or more' and the lowest frequency of length of usage is 'less than 1 year'.

Table 7.9: How long have you been using the VLS?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	7	9.7	9.7	9.7
	from 1 to less than 3 years	44	61.1	61.1	70.8
	from 3 to less than 5 years	12	16.7	16.7	87.5
	5 years or more	9	12.5	12.5	100.0
	Total	72	100.0	100.0	

7.2.2.5 Total number of distinct online/hybrid courses taught

The highest frequency for number of distinct online/hybrid courses taught is 'between 1 and 3', followed by 'greater than 6' and then 'between 4 and 6' as depicted in Table 7.10.

Table 7.10: Total number of distinct online/hybrid courses taught in your career

		Frequency	Percent	Valid %	Cumulative Percent
Valid	between 1 and 3	44	61.1	62.0	62.0
	between 4 and 6	10	13.9	14.1	76.1
	greater than 6	17	23.6	23.9	100.0
	Total	71	98.6	100.0	
Missing	System	1	1.4		
Total		72	100.0		

7.2.3 Institutions UKZN and DUT

The majority of the respondents were lecturers followed by academic ranks senior lecturer, other, associate professor, and professor, as illustrated in Table 7.11.

7.2.3.1 Academic rank

A summary of academic rank details are listed in Table 7.11 and Figure 7.1 (corresponding to Tables 7.1 and 7.6).

Table 7.11: Academic rank

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lecturer	49	45.4	45.4	45.4
	Senior Lecturer	25	23.1	23.1	68.5
	Associate Professor	10	9.3	9.3	77.8
	Professor	4	3.7	3.7	81.5
	Other	20	18.5	18.5	100.0
	Total	108	100.0	100.0	

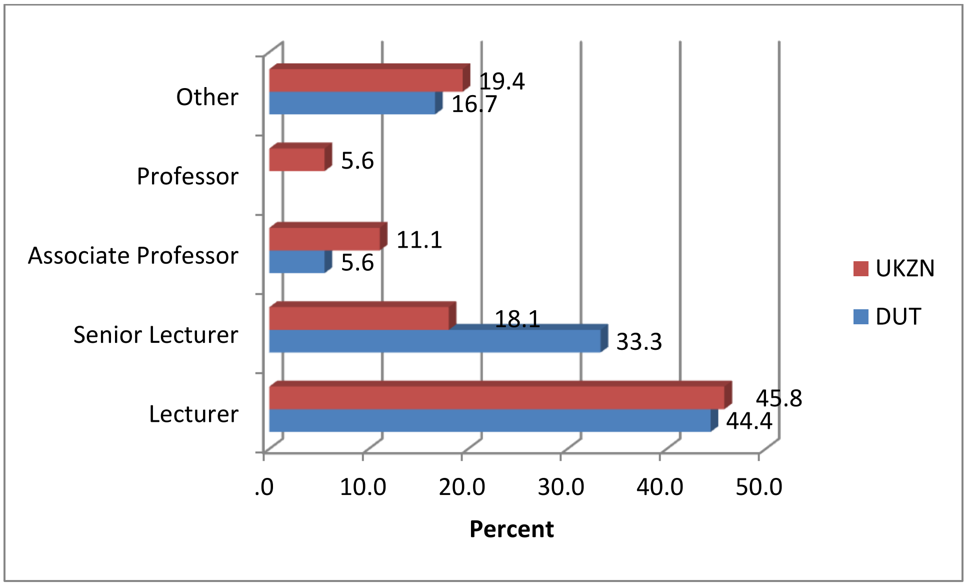

Figure 7.1: Academic rank

7.2.3.2 Academic level of study taught

Table 7.12 and Figure 7.2 (corresponding to Tables 7.2 and 7.7) provides a summary of the levels of study taught with the highest frequency of mostly undergraduate with some postgraduate, followed by undergraduate courses only, mostly postgraduate with some undergraduate and lastly postgraduate courses only.

Table 7.12: What level(s) of study do you lecture?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate courses only	38	35.2	35.8	35.8
	Postgraduate courses only	9	8.3	8.5	44.3
	Mostly undergraduate with some postgraduate	44	40.7	41.5	85.8
	Mostly postgraduate with some undergraduate	15	13.9	14.2	100.0
	Total	106	98.1	100.0	
Missing	System	2	1.9		
Total		108	100.0		

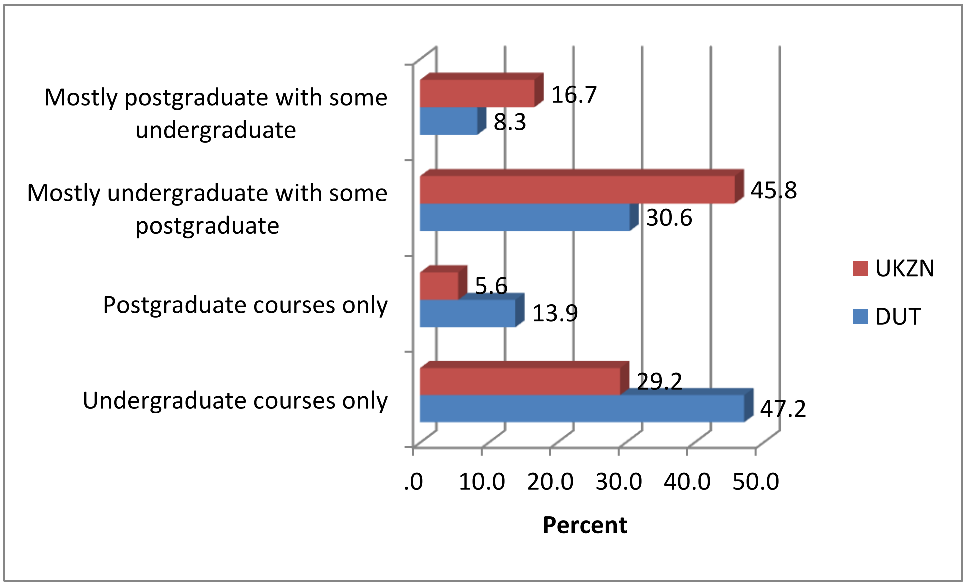

Figure 7.2: Academic level of study taught

7.2.3.3 Name of VLS currently /most currently used

Table 7.13 and Figure 7.3 (corresponding to Tables 7.3 and 7.8) summarise the virtual learning systems with Moodle being the most used, followed by Blackboard, Other, WebCT and OLS. The high frequency usage associated with Moodle can be explained by the fact that the response rate was higher at UKZN than at DUT and Moodle is the current VLS used at UKZN.

Table 7.13: Name of VLS currently being used/most recently used for your course(s)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WebCT	4	3.7	3.7	3.7
	OLS	2	1.9	1.9	5.6
	Moodle	73	67.6	67.6	73.1
	Blackboard	24	22.2	22.2	95.4
	Other	5	4.6	4.6	100.0
	Total	108	100.0	100.0	

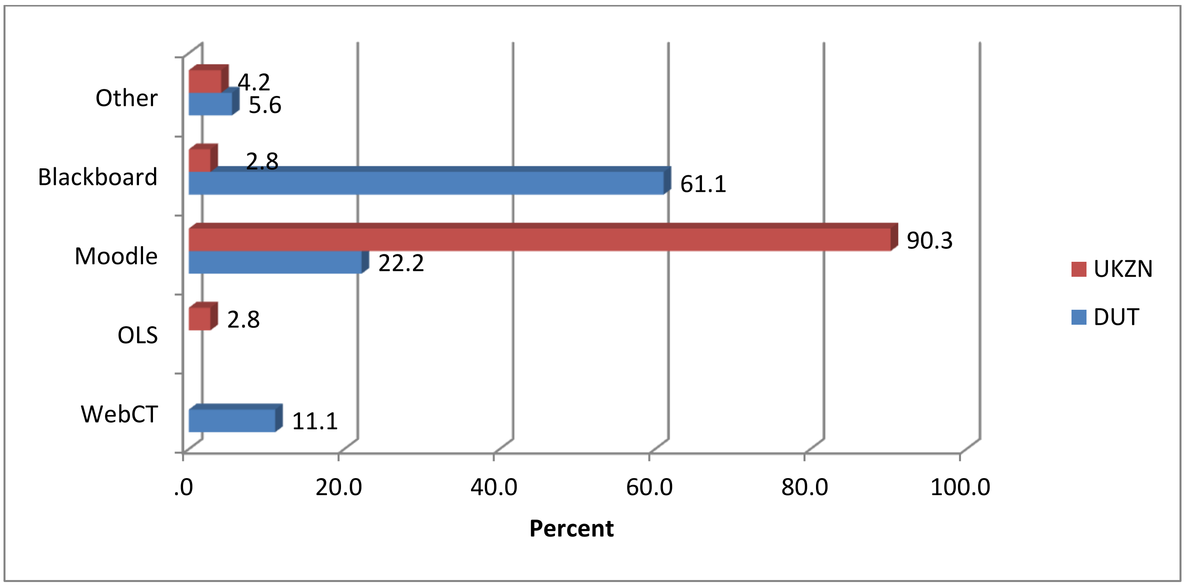

Figure 7.3: VLS currently/most recently used

7.2.3.4 Length of usage of VLS

Table 7.14 and figure 7.4 (corresponding to Tables 7.4 and 7.9) shows that the highest frequency of length of usage is 'from 1 to less than 3 years'; followed by 'from 3 to less than 5 years', '5 years or more' and the lowest frequency of length of usage is 'less than 1 year'. There is no significant difference among the lower frequency categories.

Table 7.14: How long have you been using the VLS?

		Frequency	Percentage	Valid Percent	Cumulative Percent
Valid	less than 1 year	14	13.0	13.0	13.0
	from 1 to less than 3 years	61	56.5	56.5	69.4
	from 3 to less than 5 years	17	15.7	15.7	85.2
	5 years or more	16	14.8	14.8	100.0
	Total	108	100.0	100.0	

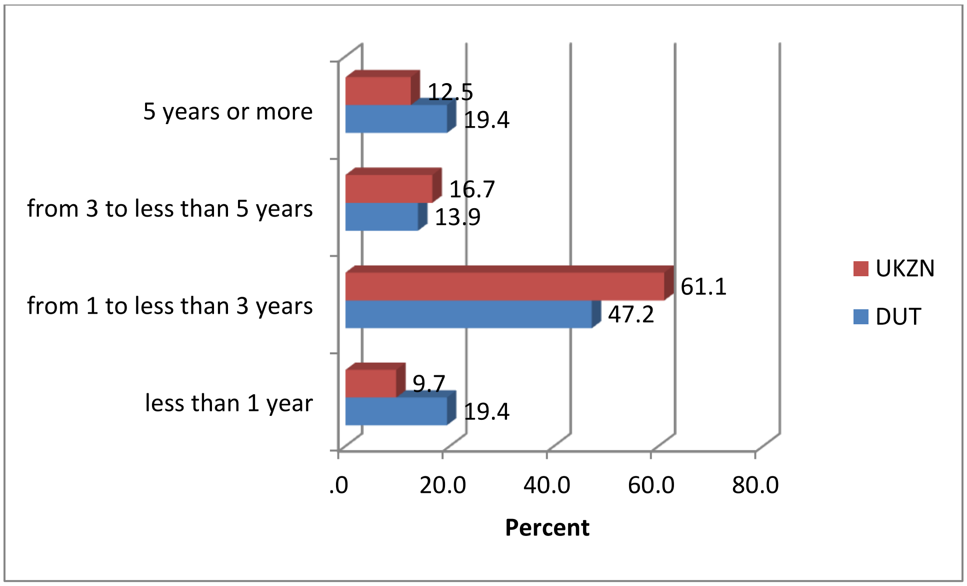

Figure 7.4: Length of usage of VLS

7.2.3.5 Total number of distinct online/hybrid courses taught

The highest frequency for number of distinct online/hybrid courses taught is ‘between 1 and 3‘, followed by ‘greater than 6’ and then ‘between 4 and 6’, as depicted in Table 7.15 and Figure 7.5 (corresponding to Tables 7.5 and 7.10).

Table 7.15: Total number of distinct online/hybrid courses taught in your career:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	between 1 and 3	68	63.0	64.2	64.2
	between 4 and 6	15	13.9	14.2	78.3
	greater than 6	23	21.3	21.7	100.0
	Total	106	98.1	100.0	
Missing	System	2	1.9		
Total		108	100.0		

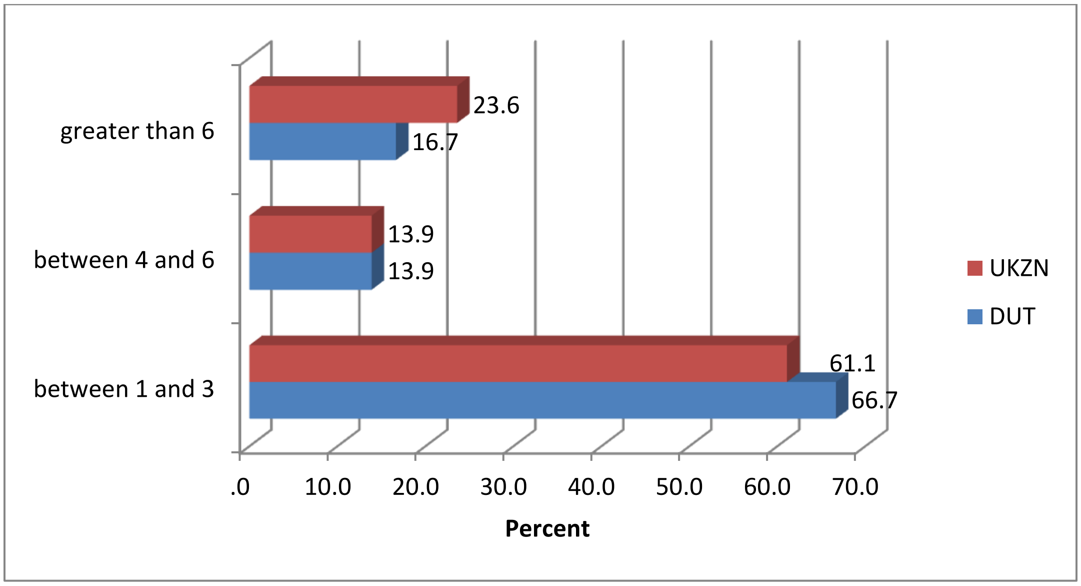

Figure 7.5: Number of online/hybrid courses taught

7.3 Analysis of actual system usage

The analysis of actual system usage, in this section discusses feature usage extent, feature usage frequency, and usage clusters for both the cases under study. A chi-square goodness-of-fit test was applied to see whether any response option was selected significantly, i.e., more or less often than the others. A significant result was found in that the response options were not selected equally (refer to Appendix 4). The frequencies for each of the usage questions for DUT, UKZN and the whole sample are listed in the Tables 7.16, 7.17 and 7.18 below. These tables show a breakdown of the frequencies associated with each of the options from ‘not at all’ to ‘usually’ for each of the 26 functions. The total ‘score’ listed in the frequency tables is an average frequency score, which is used to compare across all items in question 15 of the questionnaire and between institutions (refer to Appendix 2). Figures 7.6, 7.7

and 7.8 are graphs of frequency of feature usage for DUT, UKZN and the whole sample in order of utilisation with functions listed at the top being the least used together with corresponding usage percentages for each of the options from 'not at all' to 'usually'. The numbers 15.1 to 15.26 in Tables 7.16, 7.17 and 7.18 and Figures 7.6, 7.7 and 7.8 represent the 26 functions/features listed under question 15 of the questionnaire (refer to Appendix 2).

7.3.1 Feature usage extent and feature usage frequency for DUT case study

Table 7.16 and Figure 7.6 illustrate the extent and frequency of usage for DUT. Analysis of the 'total score' (average frequency score) of the following functions, namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; e-mail communication; creating lessons; online quizzes/ self-tests; online assignment submission; online threaded discussion forums; and online glossary shows a higher usage as these scores were above a neutral score of 3. Functions that scored lower than the neutral score of 3 were as follows: online marking of assessments/ activities with grading and comments; online tests; peer evaluation of assignments; tracking student participation in online discussion forums; grading student participation in online discussion forums; peer reviews of student posts; grading of peer reviews; publishing marks in grade book; online real time chat with students; wikis; blogs; shared whiteboard; file exchanges; student online journals; online surveys and online polls. A modest percentage, namely, 38.5 % of the VLS functions display high usage, while 61.5% of the VLS functions display lower than average usage for the institution DUT.

Table 7.16: Frequency table for feature usage at DUT

	15.1 Presenting course information	15.2 Posting course content	15.3 E-mail communication	15.4 Online real-time chat with students	15.5 Online threaded discussion forum	15.6 Shared whiteboard	15.7 Blogs	15.8 Wikis (internal/ external) for collective authoring of documents	15.9 Course announcement/ notices/ news
Not at all	2	1	4	12	5	17	14	20	2
Rarely	1	1	4	11	6	12	11	7	1
Sometimes	4	3	6	7	11	6	5	4	5
Often	12	11	6	3	6	0	2	3	16
Usually	17	20	16	3	8	1	4	2	12
Missing	0	0	0	0	0	0	0	0	0
Total 'score'	4.1	4.3	3.7	2.3	3.2	1.8	2.2	1.9	4.0

	15.10 Course calendar and schedule	15.11 Online glossary	15.12 File exchanges	15.13 Student online journals	15.14 Online quizzes/self-tests	15.15 Online test	15.16 Online assignment submission	15.17 Online marking of assessments/ activities with grading and comments	15.18 Peer reviews of student posts
Not at all	2	8	12	13	6	16	10	8	15
Rarely	3	5	4	11	5	4	2	6	5
Sometimes	4	8	6	2	6	3	6	5	8
Often	11	6	6	4	9	9	2	4	5
Usually	15	9	7	6	10	4	16	11	3
Missing	1	0	1	0	0	0	0	2	0
Total 'score'	3.9	3.1	2.7	2.4	3.3	2.5	3.3	2.9	2.3

	15.19 Grading of peer reviews	15.20 Peer evaluation of assignments	15.21 Tracking student participation in online discussion forums	15.22 Grading student participation in online discussion forums/blogs	15.23 Creating lessons	15.24 Publishing marks in grade book	15.25 Online surveys	15.26 Online polls	
Not at all	20	22	11	22	6	15	19	22	
Rarely	5	4	5	5	1	4	4	4	
Sometimes	7	6	13	7	12	3	6	4	
Often	2	0	3	1	5	3	3	3	
Usually	2	2	4	1	12	11	4	3	
Missing	0	2	0	0	0	0	0	0	
Total 'score'	1.9	1.6	2.6	1.7	3.4	2.8	2.1	1.9	

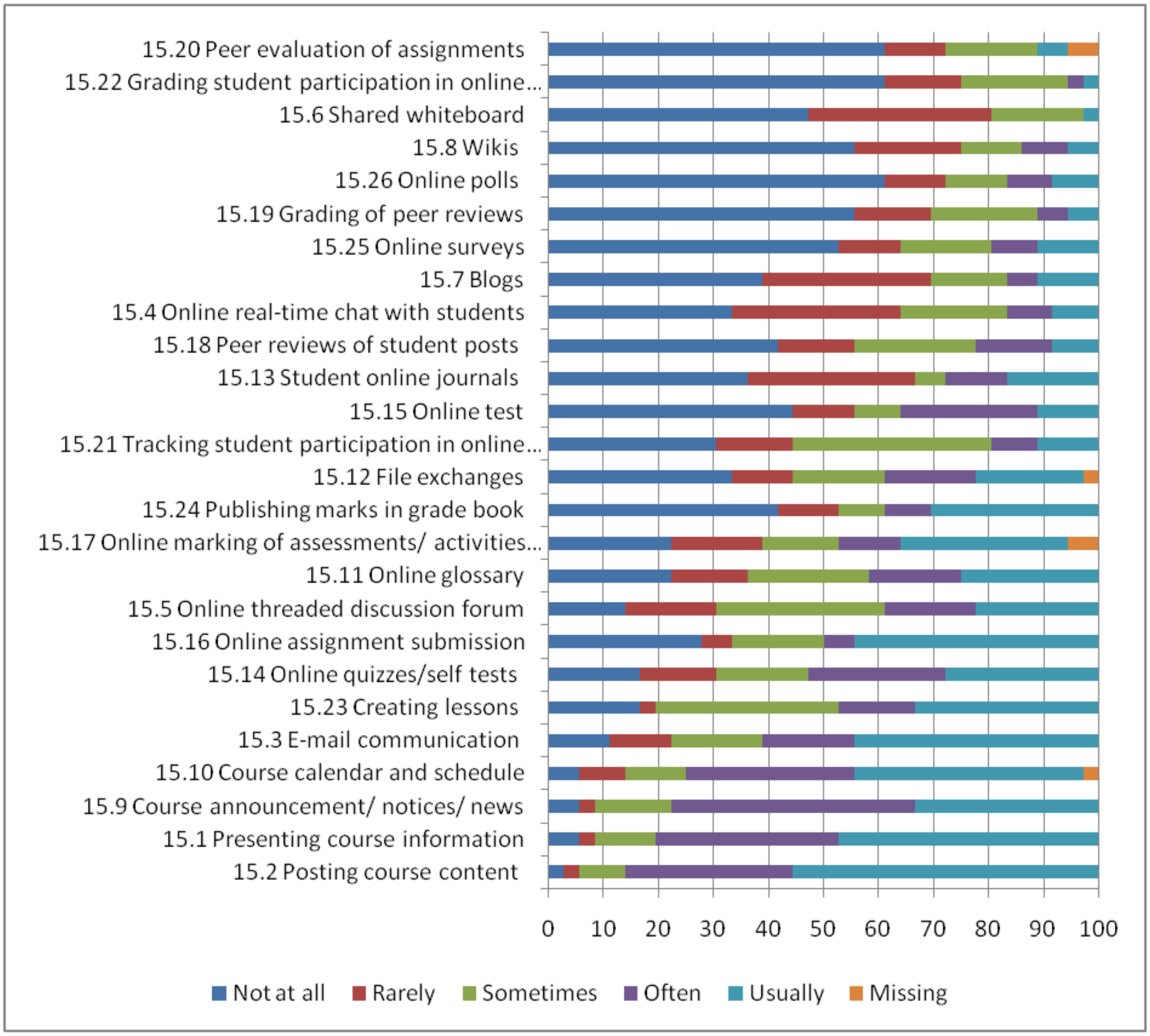

Figure 7.6: Frequency of feature usage of VLS at DUT

7.3.2 Feature usage extent and feature usage frequency for UKZN case study

Table 7.17 and Figure 7.7 illustrate the extent and frequency of usage for UKZN. Analysis of the 'total score' (average frequency score) of the following functions, namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; and e-mail communication shows a higher usage as these scores were above a neutral score of 3. Functions that scored lower than the neutral score of 3, implying lower than average usage, were as follows: online assignment submission; online marking of assessments/activities with grading and comments; online quizzes/ self-tests; online tests; peer evaluation of assignments; tracking student participation in online discussion forums; grading student participation in online discussion forums; peer reviews of student posts; grading of peer reviews; publishing marks in grade book; online threaded discussion forums; online real time chat with students; wikis; blogs; shared whiteboard; file exchanges; student online journals; creating lessons; online glossary; online surveys and online polls. A small percentage, namely, 19.2 % of the VLS functions display high usage, while 80.8 of VLS functions display lower than average usage for the institution UKZN.

Table 7.17: Frequency table for feature usage at UKZN

	15.1 Presenting course information	15.2 Posting course content	15.3 E-mail communication	15.4 Online real-time chat with students	15.5 Online threaded discussion forum	15.6 Shared whiteboard	15.7 Blogs	15.8 Wikis (internal/ external) for collective authoring of documents	15.9 Course announcement/ notices/ news
Not at all	1	0	1	32	19	51	46	49	3
Rarely	3	1	3	11	14	10	10	7	3
Sometimes	3	6	10	12	12	6	7	8	5
Often	15	16	19	6	8	1	5	6	15
Usually	50	49	39	11	19	2	3	1	45
Missing	0	0	0	0	0	2	1	1	1
Total 'score'	4.5	4.6	4.3	2.3	2.9	1.4	1.7	1.6	4.3

	15.10 Course calendar and schedule	15.11 Online glossary	15.12 File exchanges	15.13 Student online journals	15.14 Online quizzes/self-tests	15.15 Online test	15.16 Online assignment submission	15.17 Online marking of assessments/ activities with grading and comments	15.18 Peer reviews of student posts
Not at all	8	34	30	49	25	42	34	37	44
Rarely	1	9	5	6	6	7	4	4	9
Sometimes	8	11	9	8	15	9	7	8	6
Often	14	5	11	5	6	1	8	5	7
Usually	40	13	15	4	18	10	18	17	5
Missing	1	0	2	0	2	3	1	1	1
Total 'score'	4.0	2.4	2.6	1.7	2.7	1.9	2.6	2.4	1.8

	15.19 Grading of peer reviews	15.20 Peer evaluation of assignments	15.21 Tracking student participation in online discussion forums	15.22 Grading student participation in online discussion forums/blogs	15.23 Creating lessons	15.24 Publishing marks in grade book	15.25 Online surveys	15.26 Online polls	
Not at all	53	52	35	51	36	42	36	46	
Rarely	6	7	4	2	8	6	8	8	
Sometimes	7	9	8	3	10	7	10	7	
Often	3	2	11	5	6	7	8	5	
Usually	3	1	14	11	11	10	10	4	
Missing	0	1	0	0	1	0	0	2	
Total 'score'	1.6	1.5	2.5	1.9	2.2	2.1	2.3	1.7	

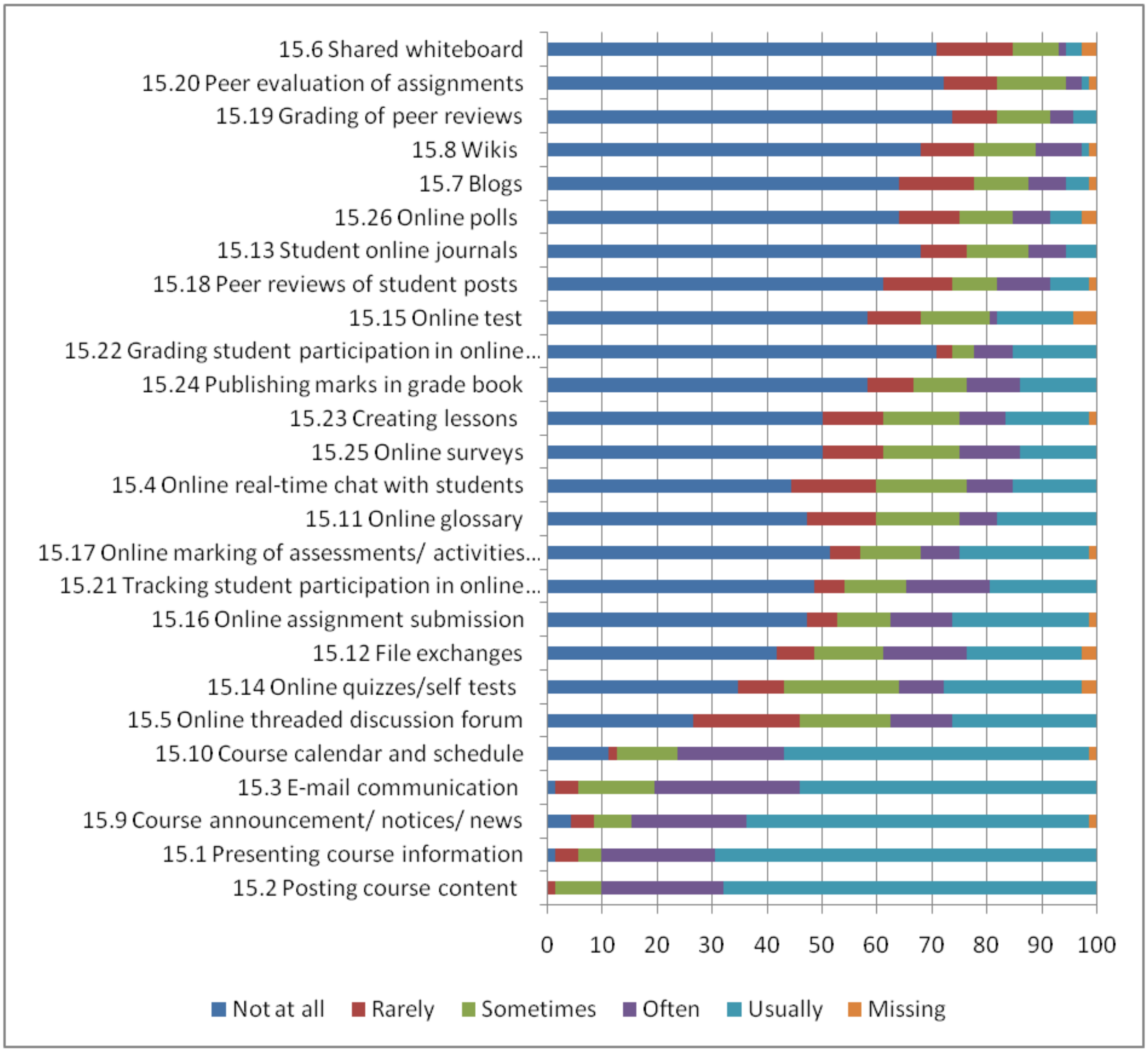

Figure 7.7: Frequency of feature usage of VLS at UKZN

7.3.3 Feature usage extent and feature usage frequency for DUT and UKZN combined

Table 7.18 and Figure 7.8 illustrate the extent and frequency of usage for the whole sample DUT and UKZN combined. Analysis of the 'total score' (average frequency score) of the following functions, namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; and e-mail communication shows a higher usage as these scores were above a neutral score of 3. The function online threaded discussion forums scored a 3 implying average usage across both institutions. Functions that scored lower than the neutral score of 3, implying lower than average usage, were as follows: online assignment submission; online marking of assessments/ activities with grading and comments; online quizzes/self-tests; online tests; peer evaluation of assignments; tracking student participation in online discussion forums; grading student participation in online discussion forums; peer reviews of student posts; grading of peer reviews; publishing marks in grade book; online real time chat with students; wikis; blogs; shared whiteboard; file exchanges; student online journals; creating lessons; online glossary; online surveys and online polls. The usage patterns for the combined sample need to be understood in terms of the ratio of respondents to the survey, with UKZN respondents constituting two-thirds and DUT constituting one third of the whole sample. Hence, the usage patterns for the whole sample were very similar to the UKZN sample.

Table 7.18: Frequency table for feature usage at DUT and UKZN

	15.1 Presenting course information	15.2 Posting course content	15.3 E-mail communication	15.4 Online real-time chat with students	15.5 Online threaded discussion forum	15.6 Shared whiteboard	15.7 Blogs	15.8 Wikis (internal/ external) for collective authoring of documents	15.9 Course announcement/ notices/ news
Not at all	3	1	5	44	24	68	60	69	5
Rarely	4	2	7	22	20	22	21	14	4
Sometimes	7	9	16	19	23	12	12	12	10
Often	27	27	25	9	14	1	7	9	31
Usually	67	69	55	14	27	3	7	3	57
Missing	0	0	0	0	0	2	1	1	1
Total ‘score’	4.4	4.5	4.1	2.3	3.0	1.5	1.9	1.7	4.2

	15.10 Course calendar and schedule	15.11 Online glossary	15.12 File exchanges	15.13 Student online journals	15.14 Online quizzes/self-tests	15.15 Online test	15.16 Online assignment submission	15.17 Online marking of assessments/ activities with grading and comments	15.18 Peer reviews of student posts
Not at all	10	42	42	62	31	58	44	45	59
Rarely	4	14	9	17	11	11	6	10	14
Sometimes	12	19	15	10	21	12	13	13	14
Often	25	11	17	9	15	10	10	9	12
Usually	55	22	22	10	28	14	34	28	8
Missing	2	0	3	0	2	3	1	3	1
Total ‘score’	4.0	2.6	2.6	2.0	2.9	2.1	2.8	2.6	2.0

	15.19 Grading of peer reviews	15.20 Peer evaluation of assignments	15.21 Tracking student participation in online discussion forums	15.22 Grading student participation in online discussion forums/blogs	15.23 Creating lessons	15.24 Publishing marks in grade book	15.25 Online surveys	15.26 Online polls
Not at all	73	74	46	73	42	57	55	68
Rarely	11	11	9	7	9	10	12	12
Sometimes	14	15	21	10	22	10	16	11
Often	5	2	14	6	11	10	11	8
Usually	5	3	18	12	23	21	14	7
Missing	0	3	0	0	1	0	0	2
Total ‘score’	1.7	1.5	2.5	1.9	2.6	2.3	2.2	1.8

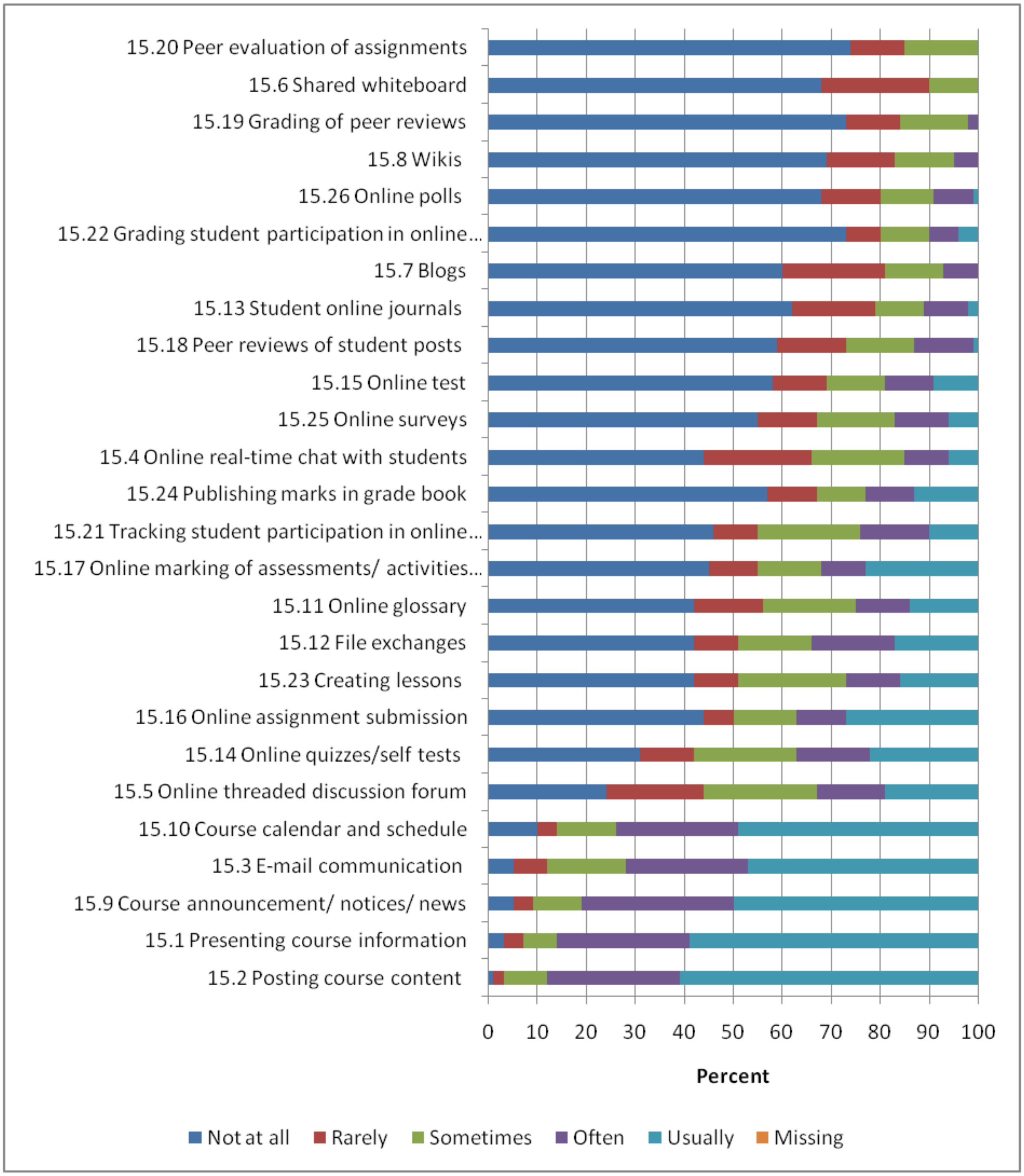

Figure 7.8: Frequency of feature usage of VLS at UKZN and DUT

7.3.4 Usage clusters

Combining all usage items for question 15 for the whole sample yields a Cronbach alpha value of .912. Table 7.19 depicts the usage groups or clusters and corresponding usage items for question 15 in the questionnaire (refer to Appendix 2); and Cronbach's Alpha values for the whole sample, and for institutions DUT and UKZN separately, based on survey responses received. The usage groups or clusters were derived from survey responses. The naming of the usage clusters was based on the predominant themes/items addressed by the survey questions. The Cronbach's alpha values were, on the whole, more than 0.7, which was acceptable for analysis. This statistic is defined in Chapter 5, section 5.6.3.

Table 7.19: Usage clusters for DUT and UKZN

SCALE	Questions	Cronbach's Alpha(all)	DUT	UKZN
Communication Cluster	15.3 E-mail communication 15.4 Online real-time chat with students 15.5 Online threaded discussion forum 15.6 Shared whiteboard 15.7 Blogs 15.9 Course announcement/ notices/ news 15.10 Course calendar and schedule 15.12 File exchanges 15.13 Student online journals	0.762	0.86	0.693
Management Cluster	15.21 Tracking student participation in online discussion forums 15.25 Online surveys 15.26 Online polls (to vote on something; research consent)	0.772	0.794	0.763
Content Cluster	15.1 Presenting course information (e.g. study guides, course outlines, timetables etc.) 15.2 Posting course content (e.g. notes; PowerPoint presentations; external link to other sources of content; tutorials; past exams; solutions etc.)	0.822	0.882	0.758
Pedagogic Cluster	15.8 Wikis (internal/ external) for collective authoring of documents 15.11 Online glossary 15.14 Online quizzes/self-tests 15.15 Online test (i.e. credit bearing) 15.16 Online assignment submission 15.17 Online marking of assessments/ activities with grading and comments 15.18 Peer reviews of student posts 15.19 Grading of peer reviews 15.20 Peer evaluation of assignments 15.22 Grading student participation in online discussion	0.874	0.9	0.849

SCALE	Questions	Cronbach's Alpha(all)	DUT	UKZN
	forums/blogs			
	15.23 Creating lessons			
	15.24 Publishing marks in grade book			

7.3.5 Analysis of usage at DUT and UKZN

The column 'Mean' in Table 7.20 gives the average usage score for the 4 usage clusters developed for actual system usage corresponding to question 15 in the questionnaire (refer to Appendix 2). A higher mean value implies more frequent usage. As can be seen from Table 7.20, the content cluster was used more than the other clusters. Analysis (independent samples t-test) shows that average usage for DUT (2.5955) of Pedagogic cluster is significantly greater than that of UKZN (2.0888), p = 0.007.

Table 7.20: Descriptive statistics of usage clusters for DUT and UKZN

	Institution	N	Mean	Std. Deviation	Std. Error Mean
Usage Communication cluster	DUT	36	2.9178	.88286	.14714
	UKZN	72	2.8450	.68345	.08054
Usage Management cluster	DUT	36	2.2037	1.15546	.19258
	UKZN	72	2.1898	1.22548	.14442
Usage Content cluster	DUT	36	4.2361	.97458	.16243
	UKZN	72	4.5486	.71286	.08401
Usage Pedagogic cluster	DUT	36	2.5955	.96503	.16084
	UKZN	72	2.0888	.87671	.10332

Average usage for the sample as a whole and separated by institution for the four usage clusters are depicted in the Table7.21.

Table 7.21: Average usage clusters for whole sample (DUT and UKZN)

Institution		Usage Communication cluster	Usage Management cluster	Usage Content cluster	Usage Pedagogic cluster
DUT	Mean	2.9178	2.2037	4.2361	2.5955
	N	36	36	36	36
	Std. Deviation	.88286	1.15546	.97458	.96503
UKZN	Mean	2.8450	2.1898	4.5486	2.0888
	N	72	72	72	72

	Std. Deviation	.68345	1.22548	.71286	.87671
Total	Mean	2.8693	2.1944	4.4444	2.2577
	N	108	108	108	108
	Std. Deviation	.75239	1.19720	.81840	.93394

7.4 Theoretical framework constructs for DUT and UKZN

Table 7.22 depicts the four factors and their corresponding constructs, sub-groups, survey questions as well as Cronbach's alpha values for the whole sample, and separated by institution. Cronbach's alpha values were mostly good as they were > 0.7. The sub-group 'Comfort and effectiveness of online course delivery' under the construct 'Experience of online teaching' has a Cronbach's alpha value<0.7 but it is close enough to 0.7 to permit analysis.

Table 7.22: Theoretical framework constructs for DUT and UKZN

	Construct	Sub-group	Survey Questions	Cronbach's Alpha(all)	DUT	UKZN
System factors	Administration	Course management	20.3,4,5,6,7,8,11	0.839	0.869	0.822
		User management	20.1,2	0.916	0.938	0.905
		Course design	20.9,10	0.842	0.854	0.841
	Assessment	Assessment and on-line marking	17.1,2,3,4	0.926	0.903	0.926
		Assignment and Grading	17.5,6,7,8,9	0.906	0.905	0.894
	Content	Content management	16.9, 19.5,6,7,8,9,10	0.887	0.893	0.874
		Content creation	19.1,2,3,4	0.856	0.843	0.859
	Student productivity and involvement	Student productivity	18.1,2,3,4,5,6,7,10	0.861	0.904	0.827
		Student involvement	18.8,9,11	0.796	0.891	0.701
	Communication	Real time and Web2.0	16.3,5,6,7,8,10	0.853	0.933	0.761
		Threaded discussion	16.1,2	0.835	0.952	0.775
		Email	16.4			
	Student tracking	Student activity/ progress tracking	17.10			
	Non-functional system characteristics	Flexibility	all 21	0.858	0.916	0.823
		Standards	all 22	0.918	0.838	0.95
		Security	23.1,2,3,4,6,7	0.914	0.891	0.917
		Privacy	23.5			
		Reliability	24.1,2,3,4	0.935	0.742	0.964
		Usability properties	25.1,2,3,4,7,8,9,10,11	0.952	0.919	0.958
		User interface design	25.5,6,12,13,14,15,16,17	0.898	0.856	0.908
		Performance	all 26	0.907	0.821	0.927
	Challenges	System challenges	28.16			

	Construct	Sub-group	Survey Questions	Cronbach's Alpha(all)	DUT	UKZN
Pedagogic factors	Pedagogic features	Instructional design	14.3,4,5,6,7	0.814	0.899	0.75
		Student centred approach	14.10,11	0.769	0.742	0.792
		Teacher centred approach	14.1,2	0.76	0.829	0.73
	Characteristics of online teaching	Teaching and learning	11.2,4,6,7,8,9	0.82	0.0803	0.821
		Communication	13.4,14.8,9,12,13	0.792	0.815	0.779
	Challenges	Pedagogic Change Management	28.7,8,12,17,18	0.778	0.774	0.784
		Pedagogical issues	28.1,4,5,6	0.798	0.698	0.831
Organisational factors	e-learning Support	Capability/support	27.1,2,3,4,5	0.837	0.735	0.849
	Challenges	Organisational e-learning policy/ procedures	28.9,10,11,17	0.763	0.734	0.789
		Organisational eLearning process capability	28.2,3,12,13,14, 15,20	0.762	0.707	0.748
User difference Factors	Experience of online teaching	Comfort and effectiveness of online course delivery	12.1,2	0.653	0.692	0.629
		Effort involved in online classroom	12.3, 13.2, 13.3, 11.3, 11.5	0.752	0.777	0.74
		Ease of online communication	13.1			
	Computer comfort level	Computer comfort level	6			
	Teaching style preference	Teaching style preference	7			
	Challenges		28.19,21,22	0.777	0.724	0.794

7.5 Analysis of theoretical framework

This section provides an analysis of the factors constituting the theoretical framework.

7.5.1 Statistical analysis of factors for whole sample DUT and UKZN

A feature level of analysis on system functions/features deemed useful for online teaching and importance attached to non-functional characteristics was conducted and the descriptive statistics are presented in Table 7.23 and Figures 7.9. The descriptive statistics for pedagogic factors is summarised in Table 7.24. The descriptive statistics for all the factors is depicted in Figure 7.10. The challenges associated with all four factors are summarised in Table 7.25 and depicted in Figure 7.11. In addition, an analysis of system factors, pedagogic factors, organisational and user difference factors was conducted, and the collective descriptive statistics for these factors are presented in Tables 7.26 and 7.27.

Table 7.23: Mean scores for system factors: functions/features and non-functional characteristics

		Administration	Assessment	Content	Student productivity and involvement	Communication	Student tracking	Non-functional characteristics
N	Valid	107	106	107	107	107	103	108
	Missing	1	2	1	1	1	5	0
Mean		4.3582	4.1238	4.1826	4.0073	3.9534	4.1748	4.4563
Std. Deviation		.53251	.66309	.50677	.60483	.59260	.83346	.43658

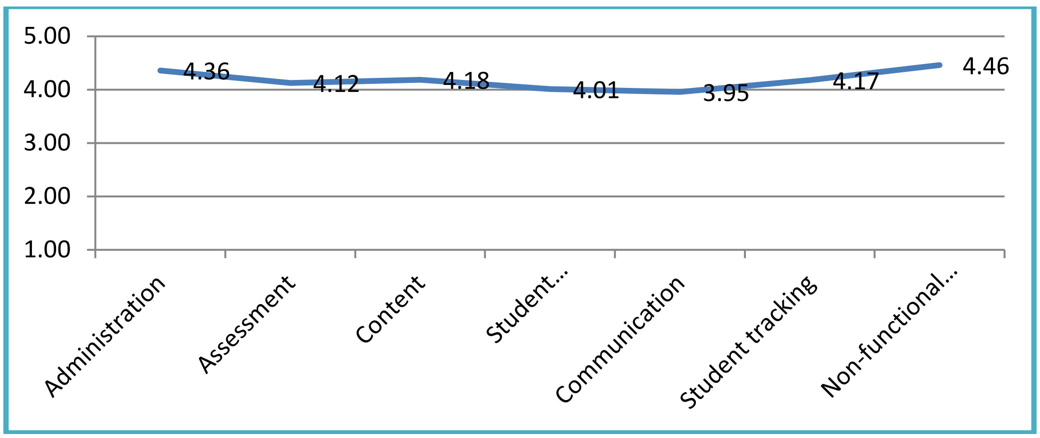

Figure 7.9: Mean scores for system factors

Analysis shows that these mean scores were all significantly above a neutral score of 3. Hence, there is significant agreement on the perceived usefulness of the System Factors: Functions/Features illustrated in Figure 7.9.

Table 7.24: Pedagogic factors

		Pedagogic features	Characteristics of online teaching
N	Valid	108	108
	Missing	0	0
Mean		4.0160	4.0241
Std. Deviation		.47285	.49580

Analysis shows that these mean scores were all significantly above a neutral score of 3. Hence, there is significant agreement on the perceived importance and need for Pedagogic factors.
All constructs are depicted in Figure 7.10 for comparison purposes.

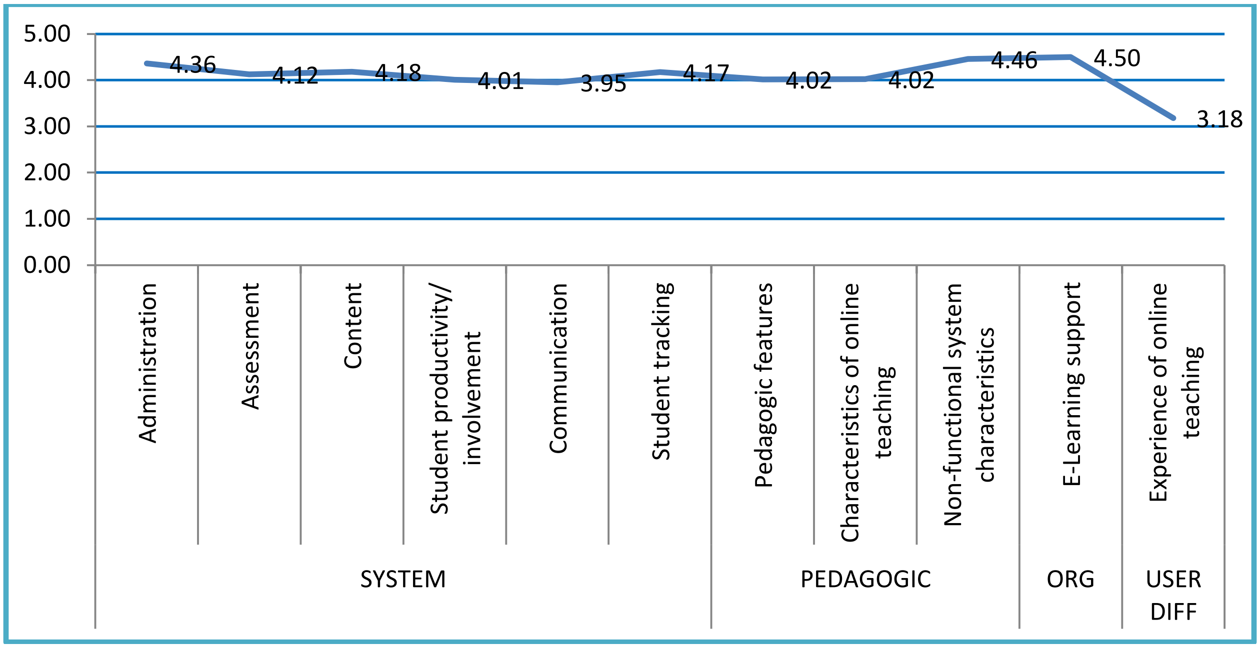

Figure 7.10: Mean scores for theoretical factors

Analysis shows that these mean scores were all significantly above a neutral score of 3. In addition to the perceived usefulness of system factors: functions/ features and perceived importance: non-functional characteristics, there was significant agreement on the pedagogic, organisational as well as user difference factors.

Table 7.25: Factor class challenges

		System factors: Challenges	Pedagogic Factors: Challenges	Organisational Factors: Challenges	User difference Factors: Challenges
N	Valid	107	108	108	106
	Missing	1	0	0	2
Mean		3.8318	3.7106	3.8308	3.8349
Std. Deviation		.96628	.70618	.67340	.87876

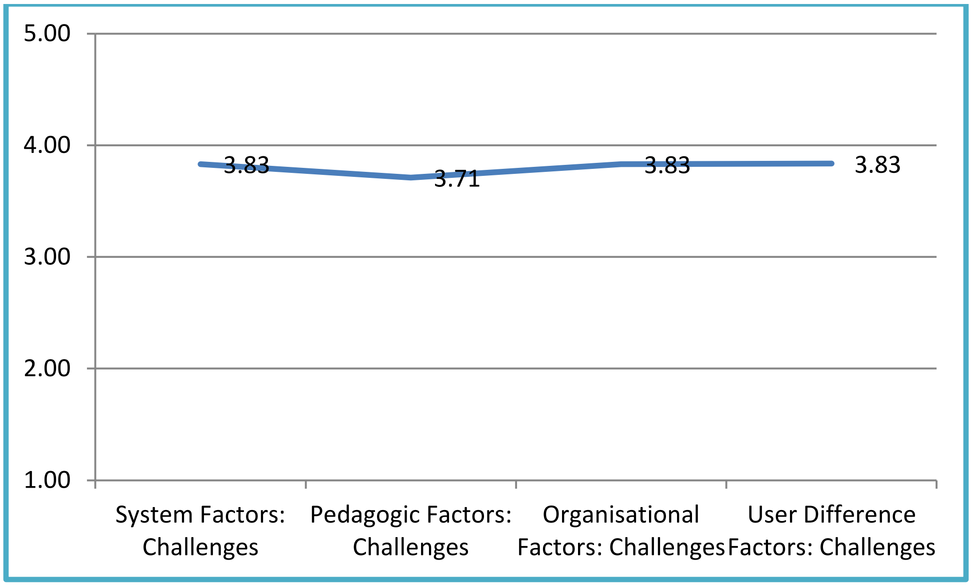

Figure 7.11: Mean scores for factor class challenges

Analysis shows that these mean scores were all significantly above a neutral score of 3. Hence there is significant agreement on the constructs: system factors: challenges, pedagogic factors: challenges, organisational factors: challenges and user difference factors: challenges.

7.5.2 Statistical analysis comparison of factors for DUT and UKZN

These average scores were then tested to ascertain whether they were significantly different for UKZN and DUT. An independent sample t-test was applied. Table 7.26 has the mean scores of factor class constructs for DUT and UKZN. Table 7.27 shows the mean difference of factor class constructs between DUT and UKZN.

Table 7.26: Average scores for factor constructs for DUT and UKZN

	1. Institution	N	Mean	Std. Deviation
System factors: Administration	DUT	35	4.3974	.56734
	UKZN	72	4.3392	.51778
System factors: Assessment	DUT	36	4.4169	.53437
	UKZN	70	3.9731	.67556
System factors: Content	DUT	35	4.3078	.53038
	UKZN	72	4.1217	.48704
System factors: Student productivity and involvement	DUT	35	4.1844	.63077
	UKZN	72	3.9213	.57677
System factors: Communication	DUT	36	4.0068	.72913
	UKZN	71	3.9263	.51356
System factors: Student tracking	DUT	34	4.3235	.72699
	UKZN	69	4.1014	.87691
System factors: Challenges	DUT	36	4.0278	.81015
	UKZN	71	3.7324	1.02759
System factors: Non-functional system characteristics	DUT	36	4.5857	.32326
	UKZN	72	4.0076	.52707
Pedagogic Factors: Pedagogic features	DUT	36	4.0329	.34578
	UKZN	72	4.0076	.52707
Pedagogic Factors: Characteristics of online teaching	DUT	36	4.1472	.48778
	UKZN	72	3.9625	.49156
Pedagogic Factors: Challenges	DUT	36	3.8171	.61171
	UKZN	72	3.6573	.74729
Organisational factors: e-learning support	DUT	36	4.7222	.41204
	UKZN	72	4.3917	.52481
Organisational factors: Challenges	DUT	36	4.0574	.51900
	UKZN	72	3.7175	.71524
User difference factors: Experience of online teaching	DUT	36	3.2273	.54633
	UKZN	72	3.1593	.61127
User difference factors: Challenges	DUT	35	3.9905	.74310
	UKZN	71	3.7582	.93384

Table 7.27: Mean differences of factor constructs between DUT and UKZN

Constructs		t	df	Sig. (2-tailed)	Mean Difference
System factors: Administration	Equal variances assumed	.529	105	.598	.05824
System factors: Assessment	Equal variances assumed	3.426	104	.001	.44380
System factors: Content	Equal variances assumed	1.802	105	.074	.18616
System factors: Student productivity and involvement	Equal variances assumed	2.147	105	.034	.26309
System factors: Communication	Equal variances not assumed	.592	53.142	.556	.08050
System factors: Student tracking	Equal variances assumed	1.276	101	.205	.22208
System factors: Challenges	Equal variances not assumed	1.623	86.584	.108	.29538
System factors: Non-functional system characteristics	Equal variances not assumed	2.505	95.783	.014	.19406
Pedagogic Factors: Pedagogic features	Equal variances assumed	.260	106	.795	.02523
Pedagogic Factors: Characteristics of online teaching	Equal variances assumed	1.846	106	.068	.18472
Pedagogic Factors: Challenges	Equal variances assumed	1.110	106	.269	.15984
Organisational Factors: e-learning support	Equal variances assumed	3.302	106	.001	.33056
Organisational Factors: Challenges	Equal variances assumed	2.534	106	.013	.33986
User difference factors: Experience of online teaching	Equal variances assumed	.564	106	.574	.06806
User difference factors: Challenges	Equal variances assumed	1.284	104	.202	.23226

Those p-values in red, namely, system factors: course assessment; system factors: student involvement and productivity; system factors: non-functional characteristics; organisational factors: e-learning support and organisational factors: challenges indicate that there were significant differences between average scores of UKZN and DUT.

7.6 Correlations between usage clusters and theoretical framework constructs

The Pearson product-moment correlation coefficient was used to analyse the relationships between factors. The Pearson product-moment correlation coefficient is widely used in the sciences as a measure of the strength of linear dependence between two variables. In statistics, dependence refers to any statistical relationship between two random variables or two sets of data (Hair, Anderson, Tatham & Black, 1998). In this study, a positive correlation with usage means that high usage is correlated with strong agreement to statements where agreement indicates that respondents think functions/features or characteristics were useful or important for online teaching.

Tables 7.28, 7.29 and 7.30 summarise the correlations between usage clusters and theoretical framework constructs.

7.6.1 Correlations between usage clusters and the theoretical framework constructs for DUT

Table 7.28 summarises the correlations between usage clusters and theoretical framework constructs for DUT.

Table 7.28: DUT Correlations

			Usage							
	Construct	**Sub-group**	**Communication cluster**		**Management cluster**		**Content cluster**		**Pedagogic cluster**	
			r	**p**	**r**	**p**	**r**	**p**	**r**	**p**
System factors	Administration	Course management	.374*	.027	.203	.243	.353*	.037	.342*	.044
		User management	.181	.306	.074	.678	.239	.173	.256	.144
		Course design	.437**	.010	.305	.079	.579**	.000	.462**	.006
	Assessment	Assessment and on-line marking	.442**	.008	.264	.126	.450**	.007	.425*	.011
		Assignment and Grading	.458**	.005	.410*	.013	.542**	.001	.346*	.039
	Content	Content management	.414*	.013	.429*	.010	.370*	.029	.402*	.017
		Content creation	.411*	.014	.312	.068	.319	.062	.329	.054
	Student productivity and involvement	Student productivity	.431**	.010	.490**	.003	.452**	.006	.465**	.005
		Student involvement	.419*	.012	.395*	.019	.347*	.041	.318	.063
	Communication	Real time and Web2.0	.432*	.011	.482**	.004	.200	.257	.397*	.020
		Threaded discussion	.588**	.000	.412*	.016	.264	.132	.476**	.004
		Email	.452**	.006	.282	.100	.439**	.008	.267	.122
	Student tracking	Student tracking	.399*	.019	.513**	.002	.192	.277	.267	.127
	Non-functional system characteristics	Performance	.341*	.042	.379*	.023	.291	.085	.252	.137
		Flexibility	.292	.084	.459**	.005	.169	.325	.214	.210
		Standards	.402*	.015	.207	.226	.221	.195	.264	.119
		Security	.329	.050	.145	.398	.304	.072	.234	.169
		Privacy	.076	.659	.269	.112	.230	.177	.216	.205
		Reliability	.259	.126	.281	.097	.419*	.011	.158	.356
		Usability properties	.303	.073	.465**	.004	.230	.177	.266	.117

	Construct	Sub-group	Usage							
			Communication cluster		Management cluster		Content cluster		Pedagogic cluster	
		User interface design	.345*	.039	.145	.399	.480**	.003	.290	.087
	Challenges	System challenges	.100	.560	.299	.076	.118	.493	.205	.231
Pedagogic factors	Pedagogic features	Instructional design	.250	.142	.090	.602	.063	.713	.320	.057
		Student centred approach	.273	.108	.052	.763	.301	.075	.232	.173
		Teacher centred approach	-.154	.370	-.067	.699	.110	.522	-.155	.366
	Characteristics of online teaching	Teaching and learning	.419*	.011	.237	.165	.219	.199	.369*	.027
		Communication	.145	.399	-.088	.610	.388*	.019	.046	.789
	Challenges	Pedagogic Change Management	-.059	.733	.361*	.031	-.004	.983	-.034	.844
		Pedagogical issues	.034	.845	.197	.249	.199	.246	.054	.753
Organisationa l factors	e-learning support	Capability/support	.145	.399	.218	.201	.310	.066	.264	.120
	Challenges	Organisational e-learning policy/ procedure	.015	.931	.285	.092	.140	.414	.150	.383
		Organisational eLearning process capability	.258	.129	.354*	.034	.229	.178	.389*	.019
User difference Factors	Experience of online teaching	Comfort and effectiveness of online course delivery	.704**	.000	.464**	.004	.560**	.000	.591**	.000
		Effort involved in online classroom	.226	.185	.198	.246	-.102	.554	.330*	.050
		Ease of online communication	.003	.987	.022	.901	-.041	.812	-.010	.954
	Computer comfort level	Computer comfort level								
	Teaching style preference	Teaching style/preference								
	Challenges	Challenges	.089	.612	.230	.185	.245	.156	.176	.312

7.6.2 Correlations between usage clusters and the theoretical framework constructs for UKZN

Table 7.29 summarises the correlations between usage clusters and theoretical framework constructs for UKZN.

Table 7.29: UKZN Correlations

			Usage							
	Construct	Sub-group	Communication cluster		Management cluster		Content cluster		Pedagogic cluster	
			r	p	r	p	r	p	r	p
System factors	Administration	Course management	-.011	.927	-.107	.373	.238*	.044	.001	.993
		User management	-.043	.721	-.034	.774	.228	.054	.022	.856
		Course design	.118	.332	.009	.940	.506**	.000	-.016	.896
	Assessment	Assessment and on-line marking	-.090	.467	-.052	.678	.129	.297	-.026	.832
		Assignment and Grading	.035	.776	.070	.567	.098	.424	.157	.196
	Content	Content management	.193	.103	.005	.965	-.016	.896	-.047	.695
		Content creation	.030	.808	-.105	.386	.213	.077	-.039	.751
	Student productivity and involvement	Student productivity	.090	.458	-.031	.795	.217	.069	.060	.617
		Student involvement	.108	.376	.157	.196	.013	.919	.218	.072
	Communication	Real time and Web2.0	.445**	.000	.271*	.025	.057	.643	.306*	.011
		Threaded discussion	.478**	.000	.407**	.000	.169	.161	.386**	.001
		Email	.266*	.030	.160	.195	.111	.372	.114	.359
	Student tracking	Student tracking	.075	.542	.123	.313	.053	.663	.089	.467
	Non-functional system characteristics	Flexibility	-.058	.631	-.013	.910	.181	.127	.047	.697
		Standards	-.012	.917	-.190	.109	.089	.458	-.157	.187
		Security	.031	.793	-.060	.619	.231	.0504	-.082	.494
		Privacy	-.086	.479	-.113	.350	.219	.068	-.214	.076
		Reliability	-.098	.411	-.173	.135	.209	.078	-.199	.093
		Usability properties	-.121	.312	-.142	.234	.227	.055	-.158	.185
		User interface design	.027	.821	-.049	.687	.161	.180	-.054	.657
		Performance	.031	.794	-.130	.278	.233	.049	-.132	.269

	Construct	Sub-group	Usage							
			Communication cluster		Management cluster		Content cluster		Pedagogic cluster	
	Challenges	System challenges	-.015	.898	-.029	.810	-.038	.756	.014	.905
Pedagogic factors	Pedagogic features	Instructional design	.068	.570	.115	.335	-.038	.751	.060	.616
		Student centred approach	.285	.015	.191	.109	.084	.483	.127	.289
		Teacher centred approach	-.119	.321	-.173	.147	.153	.201	-.255	.031
	Characteristics of online teaching	Teaching and learning	.247	.037	.189	.112	.336	.004	.281	.017
		Communication	.357	.002	.156	.190	.230	.052	.151	.205
	Challenges	Pedagogic Change Management	-.097	.421	-.250	.036	-.012	.923	-.254	.033
		Pedagogical Issues	-.189	.111	-.296	.012	-.025	.832	-.251	.033
Organisational factors	e-learning support	Capability/support	-.011	.926	-.025	.833	.238*	.044	-.125	.296
	Challenges	Organisational e-learning policy/ procedure	.055	.650	-.041	.733	-.008	.946	-.111	.357
		Organisational eLearning process capability	-.075	.530	-.095	.429	-.037	.759	-.128	.282
User difference Factors	Experience of online teaching	Comfort and effectiveness of online course delivery	.490**	.000	.495**	.000	.244*	.039	.499**	.000
		Effort involved in online classroom	-.079	.511	-.192	.106	-.111	.352	-.222	.061
		Ease of online communication	.073	.544	-.065	.588	.324**	.006	.031	.794
	Computer comfort level	Computer comfort level								
	Teaching style preference	Teaching style preference								
	Challenges	Challenges	-.086	.478	-.169	.159	-.101	.404	-.170	.156

7.6.3 Correlations between usage clusters and the theoretical framework constructs for DUT and UKZN combined

Table 7.30 summarise the correlations between usage clusters and theoretical framework constructs for DUT and UKZN.

Table 7.30: DUT and UKZN Correlations

			Usage							
	Construct	Sub-group	Communication cluster		Management cluster		Content cluster		Pedagogic cluster	
			r	p	r	p	r	p	r	p
System factors	Administration	Course management	0.143	0.143	0.056	0.570	.240*	0.013	0.143	0.143
		User management	0.049	0.616	-0.008	0.932	.270**	0.005	0.101	0.301
		Course design	.233*	0.017	0.073	0.460	.471**	0.000	0.124	0.208
	Assessment	Assessment and on-line marking	0.091	0.363	0.042	0.672	0.112	0.262	0.147	0.141
		Assignment and Grading	0.187	0.056	0.138	0.161	0.133	0.177	.226*	0.020
	Content	Content management	.286**	0.003	0.171	0.079	0.053	0.586	0.144	0.139
		Content creation	0.184	0.06	0.037	0.708	.222*	0.023	0.116	0.237
	Student productivity and Involvement	Student productivity	.225*	0.02	0.188	0.053	.203*	0.037	.229*	0.018
		Student involvement	.242*	0.013	.259**	0.008	0.024	0.810	.326**	0.001
	Communication	Real time and Web2.0	.438**	0	.354**	0.000	-0.007	0.944	.337**	0.001
		Threaded discussion	.522**	0	.429**	0.000	0.113	0.255	.412**	0.000
		Email	.347**	0	0.139	0.163	.265**	0.007	0.125	0.209
	Student tracking	Student tracking	0.19	0.055	.273**	0.005	0.034	0.736	0.168	0.089
	Non-functional system characteristics	Flexibility	.104	.283	.111	.252	.185	.055	.159	.101
		Standards	.096	.323	-.003	.972	.106	.276	-.026	.792
		Security	.147	.129	.007	.941	.173	.073	.064	.507
		Privacy	.031	.753	-.054	.586	.176	.071	-.038	.702
		Reliability	-.042	.664	-.084	.388	.164	.090	-.056	.563
		Usability properties	.004	.967	-.038	.699	.230*	.017	-.018	.857
		User interface design	.123	.206	.093	.341	.143	.141	.087	.371

			Usage							
	Construct	Sub-group	Communication cluster		Management cluster		Content cluster		Pedagogic cluster	
		Performance	.128	.185	-.060	.536	.262**	.006	.024	.803
	Challenges	System challenges	0.029	0.764	0.058	0.553	-0.005	0.957	0.064	0.515
Pedagogic factors	Pedagogic features	Instructional design	.150	.121	.105	.279	.000	.997	.171	.077
		Student centred approach	.281**	.003	.145	.134	.155	.109	.178	.066
		Teacher centred approach	-.134	.167	-.139	.151	.143	.140	-.228*	.018
	Characteristics of online teaching	Teaching and learning	.311**	.001	.201*	.037	.246*	.010	.339**	.000
		Communication	.275**	.004	.079	.418	.266**	.005	.136	.162
	Challenges	Pedagogic Change Management	-.073	.453	-.072	.463	-.037	.703	-.129	.186
		Pedagogical issues	-.107	.272	-.155	.109	.048	.624	-.138	.154
Organisational factors	e-learning support	Capability/support	0.052	0.594	0.040	0.685	0.183	0.058	0.071	0.468
	Challenges	Organisational e-learning policy/ procedure	0.047	0.630	0.056	0.568	0.014	0.890	0.022	0.822
		Organisational eLearning process capability	0.036	0.709	0.013	0.890	-0.012	0.901	0.085	0.380
User difference Factors	Experience of online teaching	Comfort and effectiveness of online course delivery	.569**	0.000	.476**	0.000	.321**	0.001	.555**	0.000
		Effort involved in online classroom	0.040	0.679	-0.063	0.517	-0.089	0.358	-0.041	0.674
		Ease of online communication	0.047	0.626	-0.042	0.665	.192*	0.046	0.014	0.888
	Computer comfort level	Computer comfort level								
	Teaching style preference	Teaching style/preference								
	Challenges	Challenges	-0.020	0.839	-0.057	0.559	-0.006	0.948	-0.026	0.792

7.7 Correlations between actual system usage and demographic factors

This section examines the correlations between actual system usage and demographic factors. Actual system usage in this section refers to two categories of usage namely usage clusters and total system usage.

7.7.1 Correlations between actual system usage and length of usage

Tables 7.31, 7.32 and 7.33 summarise the descriptive statistics for the demographic factor: length of usage across all four usage clusters.

7.7.1.1 Descriptive statistics for demographic factor: length of usage and correlations between usage clusters and length of usage for DUT

Table 7.31summarises the descriptive statistics for the demographic factor: length of usage across all four usage clusters for DUT.

Table 7.31: Length of usage correlations for DUT

		N	Mean	Std. Deviation
Usage Communication cluster	less than 1 year	7	1.9206	.55077
	from 1 to less than 3 years	17	2.9894	.74133
	from 3 to less than 5 years	5	3.3333	.74120
	5 years or more	7	3.4444	.87724
	Total	36	2.9178	.88286
Usage Management cluster	less than 1 year	7	1.5714	.68622
	from 1 to less than 3 years	17	2.2157	1.30672
	from 3 to less than 5 years	5	2.3333	.78174
	5 years or more	7	2.7143	1.25357
	Total	36	2.2037	1.15546
Usage Content cluster	less than 1 year	7	3.4286	1.39728
	from 1 to less than 3 years	17	4.1471	.84344
	from 3 to less than 5 years	5	4.8000	.27386
	5 years or more	7	4.8571	.37796
	Total	36	4.2361	.97458
Usage Pedagogic cluster	less than 1 year	7	1.7976	.84418
	from 1 to less than 3 years	17	2.5855	.66618
	from 3 to less than 5 years	5	2.6000	.88859
	5 years or more	7	3.4145	1.21838
	Total	36	2.5955	.96503

The results obtained from applying ANOVA: to 'length of usage' data were as follows:

- Communication cluster: Those with less than 1 year's usage, show lower utilization of functions/features than the other categories, with $P < .002$.
- Content cluster: Those with from 1 – 3 year's usage, show lower utilization of functions/features than those with more than 5 years usage, with $P=0.033$.
- Pedagogic cluster: Those with less than 1 year's usage, show lower utilization of functions/features than those with more than 5 years usage, with $P = 0.013$.

7.7.1.2 Correlations between usage clusters and length of usage for UKZN

Table 7.32 summarises the descriptive statistics for the demographic factor: length of usage across all four usage clusters for UKZN.

Table 7.32: Length of usage correlations for UKZN

		N	Mean	Std. Deviation
Usage Communication cluster	less than 1 year	7	2.2381	.82509
	from 1 to less than 3 years	44	2.9136	.61440
	from 3 to less than 5 years	12	2.7847	.82811
	5 years or more	9	3.0617	.50647
	Total	72	2.8450	.68345
Usage Management cluster	less than 1 year	7	1.2857	.52453
	from 1 to less than 3 years	44	2.2803	1.31763
	from 3 to less than 5 years	12	2.2222	1.25797
	5 years or more	9	2.4074	.89408
	Total	72	2.1898	1.22548
Usage Content cluster	less than 1 year	7	4.0000	1.11803
	from 1 to less than 3 years	44	4.6023	.66978
	from 3 to less than 5 years	12	4.6250	.52764
	5 years or more	9	4.6111	.69722
	Total	72	4.5486	.71286
Usage Pedagogic cluster	less than 1 year	7	1.5833	.60285
	from 1 to less than 3 years	44	2.1424	.98032
	from 3 to less than 5 years	12	2.1010	.69740
	5 years or more	9	2.2037	.67843
	Total	72	2.0888	.87671

The result obtained from applying ANOVA: to 'length of usage' data was as follows:

- Management cluster: Those with less than 1 year's usage, show lower utilization of functions/features than those with 1 – 3 and more than 5 years usage with $P = 0.007$.

7.7.1.3 Correlations between usage clusters and length of usage for DUT and UKZN combined

Table 7.33 summarises the descriptive statistics for the demographic factor: length of usage across all four usage clusters for DUT and UKZN.

Table 7.33: Length of usage correlations for DUT and UKZN

		N	Mean	Std. Deviation
Usage Communication cluster	less than 1 year	14	2.0794	.69379
	from 1 to less than 3 years	61	2.9347	.64673
	from 3 to less than 5 years	17	2.9461	.82171
	5 years or more	16	3.2292	.69504
	Total	108	2.8693	.75239
Usage Management cluster	less than 1 year	14	1.4286	.60523
	from 1 to less than 3 years	61	2.2623	1.30400
	from 3 to less than 5 years	17	2.2549	1.11511
	5 years or more	16	2.5417	1.03905
	Total	108	2.1944	1.19720
Usage Content cluster	less than 1 year	14	3.7143	1.25137
	from 1 to less than 3 years	61	4.4754	.74401
	from 3 to less than 5 years	17	4.6765	.46574
	5 years or more	16	4.7188	.57645
	Total	108	4.4444	.81840
Usage Pedagogic cluster	less than 1 year	14	1.6905	.71345
	from 1 to less than 3 years	61	2.2659	.92044
	from 3 to less than 5 years	17	2.2478	.76596
	5 years or more	16	2.7334	1.10639
	Total	108	2.2577	.93394

Applying ANOVA: There is a significant difference of average usage for the different categories of the demographic factor: length of usage for all four usage clusters.

- Communication cluster: Those with less than 1 year's usage, show lower utilization of functions/features than the other categories, with $P < .0005$.
- Management cluster: Those with less than 1 year's usage, show lower utilization of functions/features than those with 1 – 3 and more than 5 years usage, with $P = 0.021$.
- Content cluster: A difference exists (nothing specific) between utilization of features for the different usage categories, with $P=0.009$.
- Pedagogic cluster: Those with less than 1 year's usage, show lower utilization of functions/features than those with more than 5 years usage, with $P = 0.023$.

7.7.1.4 Correlations between total system usage and length of usage

For DUT there is a significant positive correlation ($r = .544$, $p = .001$) but for UKZN there is not a significant correlation. (This was tested using non-parametric tests as well as the usage is a 4-pt ordinal scale so should not strictly be used as continuous). Overall, for the whole sample, there is a correlation between total system usage and the demographic factor: length of use (r = .323, p = .001).

7.7.2 Correlations between actual system usage and number of courses taught

Tables 7.34, 7.35 and 7.36 summarise the descriptive statistics for the demographic factor: number of courses taught across all four usage clusters.

7.7.2.1 Correlations between usage clusters and number of courses taught for DUT

Table 7.34 summarises the descriptive statistics for the demographic factor: number of courses taught across all four usage clusters for DUT.

Table 7.34: Number of courses taught correlations for DUT

		N	Mean	Std. Deviation
Usage Communication cluster	between 1 and 3	24	2.8212	.76041
	between 4 and 6	5	2.8222	1.06458
	greater than 6	6	3.7037	.59904
	Total	35	2.9726	.83132
Usage Management cluster	between 1 and 3	24	2.1667	1.00241
	between 4 and 6	5	1.8000	1.60900
	greater than 6	6	2.8889	1.27657
	Total	35	2.2381	1.15349
Usage Content cluster	between 1 and 3	24	4.2292	.79371
	between 4 and 6	5	4.0000	1.06066
	greater than 6	6	5.0000	.00000
	Total	35	4.3286	.81297
Usage Pedagogic cluster	between 1 and 3	24	2.3639	.80183
	between 4 and 6	5	2.6106	.73850
	greater than 6	6	3.7753	.82956
	Total	35	2.6411	.93897

The result obtained from applying ANOVA: to ‘number of course taught’ data was as follows:

- Pedagogic cluster: Those who taught >6 courses, shower higher utilization of functions/features than those who taught between 1 and 3 courses, with P value is = 0.002.

7.7.2.2 Correlations between usage clusters and number of courses taught for UKZN

Table 7.35 summarises the descriptive statistics for the demographic factor: number of courses taught across all four usage clusters for UKZN.

Table 7.35: Number of courses taught correlations for UKZN

		N	Mean	Std. Deviation
Usage Communication cluster	between 1 and 3	44	2.6711	.65963
	between 4 and 6	10	3.0194	.75972
	greater than 6	17	3.1716	.59611
	Total	71	2.8400	.68698
Usage Management cluster	between 1 and 3	44	2.0682	1.22755
	between 4 and 6	10	2.3333	1.26686
	greater than 6	17	2.4902	1.21402
	Total	71	2.2066	1.22587
Usage Content cluster	between 1 and 3	44	4.4432	.79399
	between 4 and 6	10	4.8000	.34960
	greater than 6	17	4.6471	.63158
	Total	71	4.5423	.71587
Usage Pedagogic cluster	between 1 and 3	44	1.9850	.79853
	between 4 and 6	10	2.2355	.93147
	greater than 6	17	2.3235	1.02862
	Total	71	2.1013	.87645

The result obtained from applying ANOVA: to ‘length of usage’ data was as follows:

- Communication cluster: Those who taught >6 courses, shower higher utilization of functions/features than those who taught between 1 and 3 courses, with P value < .024.

7.7.2.3 Correlations between usage clusters and number of courses taught for DUT and UKZN combined

Table 7.36 summarises the descriptive statistics for the demographic factor: number of courses taught across all four usage clusters for DUT and UKZN.

Table 7.36: Number of courses taught correlations for DUT and UKZN

		N	Mean	Std. Deviation
Usage Communication cluster	between 1 and 3	68	2.7241	.69496
	between 4 and 6	15	2.9537	.83911
	greater than 6	23	3.3104	.63014
	Total	106	2.8838	.73644
Usage Management cluster	between 1 and 3	68	2.1029	1.14642
	between 4 and 6	15	2.1556	1.35615
	greater than 6	23	2.5942	1.21421
	Total	106	2.2170	1.19704
Usage Content cluster	between 1 and 3	68	4.3676	.79465
	between 4 and 6	15	4.5333	.74322
	greater than 6	23	4.7391	.56144
	Total	106	4.4717	.75224
Usage Pedagogic cluster	between 1 and 3	68	2.1187	.81439
	between 4 and 6	15	2.3605	.86435
	greater than 6	23	2.7022	1.16221
	Total	106	2.2795	.92879

- Communication: Those who taught > 6 courses, shower higher utilization of functions/features than those who taught between 1 and 3 courses, with $P < .003$.
- Pedagogic: Those who taught > 6 courses, shower higher utilization of functions/features than those who taught between 1 and 3 courses, with $P = 0.030$.

7.7.2.4 Correlations between total system usage and number of courses taught

For DUT, there is a significant positive correlation ($r = .479$, $p = .004$) between total system usage and number of courses taught. For UKZN, there is there is a significant positive correlation between total system usage and number of courses taught ($r = .242$, $p = .042$). Overall, for the whole sample, there is a correlation ($r = .300$, $p = .002$).

7.7.3 Correlations between total system usage and level of study

Total usage by level of study

The results show that there is no significant usage difference for the different levels of study at DUT. At UKZN, those who lecture mostly postgraduate and some undergraduate have higher usage that those who lecture mostly undergraduate and some postgraduate. (Kruskal Wallis test – chi-square value = 14.871, degrees of freedom (df) = 3, p = .002).

Total sample: those who lecture mostly postgraduate and some undergraduate have higher usage that those who lecture mostly undergraduate and some postgraduate as well as those who lecture only undergraduate.
(Kruskal Wallis test – chi-square value = 14.758, degrees of freedom (df) = 3, p = .002).

7.7.4 Correlations between total system usage and academic rank

There is no significant correlation between total system usage and academic rank.

7.8 Correlations between total system usage and system, pedagogic, organisational and user difference factors and inter-factor correlations

Separate constructs were grouped together for each of the factors. The descriptive statistics for the factors of the whole sample is depicted in Table 7.37. Table 7.38 and Figure 7.12 depict the relationships between the four factors and between the factors and actual system usage.

Table 7.37: Descriptive statistics for factors of whole sample DUT and UKZN

		System factors corresponding to perceived usefulness and perceived importance	Pedagogic factors	Organisational factors: e-learning support	User difference factors: Experience of online teaching
N	Valid	108	108	108	108
	Missing	0	0	0	0
Mean		4.1397	4.1655	4.5019	3.1819
Std. Deviation		.46940	.35370	.51264	.58874

Table 7.38: Correlations among factors for DUT and UKZN

		System factors corresponding to perceived usefulness and perceived importance	Pedagogic factors	Organisational factors: e-learning Support	User difference factors: Experience of online teaching	Total usage
System factors corresponding to perceived usefulness and perceived importance	Pearson Correlation	1	.585**	.389**	.071	.321**
	Sig. (2-tailed)		.000	.000	.466	.001
	N	108	108	108	108	108
Pedagogic factors	Pearson Correlation	.585**	1	.644**	.180	.241*
	Sig. (2-tailed)	.000		.000	.062	.012
	N	108	108	108	108	108
Organisational factors: e-learning support	Pearson Correlation	.389**	.644**	1	.034	.077
	Sig. (2-tailed)	.000	.000		.726	.426
	N	108	108	108	108	108
User difference factors: Experience of online teaching	Pearson Correlation	.071	.180	.034	1	.316**
	Sig. (2-tailed)	.466	.062	.726		.001
	N	108	108	108	108	108
Total usage	Pearson Correlation	.321**	.241*	.077	.316**	1
	Sig. (2-tailed)	.001	.012	.426	.001	
	N	108	108	108	108	108
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

The values in red mean significant correlation. Total system usage is positively correlated with three of the fours factors, namely, system factors, pedagogic factors and user difference factors.

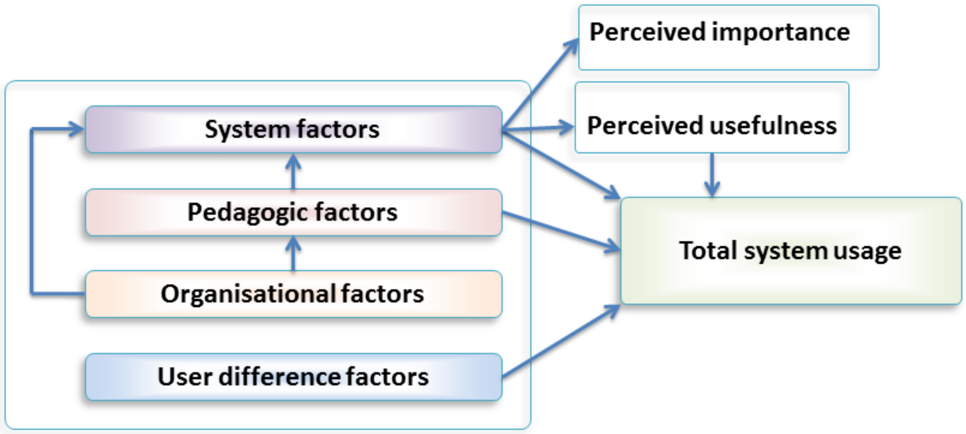

Figure 7.12: Relationships among factors and between factors and total system usage

The arrows in Figure 7.12 represent correlations between the following factors and total system usage:

- System factors corresponding to perceived usefulness and perceived importance.
- Pedagogic factors.
- User difference factors.

The following correlations were found between factors:

- System factors corresponding to perceived usefulness and perceived importance and pedagogic factors.
- System factors corresponding to perceived usefulness and perceived importance and organisational factors.
- Pedagogic factors and organisational factors.

7.9 Correlations between total system usage and constructs within the respective factors, and between separate constructs for different factors

Correlations between total system usage and constructs within the four main factors were covered in sub-sections 7.9.1 to 7.9.4.

7.9.1 Correlation between total system usage and constructs of the system factor class

Table 7.39 and Figure 7.13 depict the relationships between total system usage and system factor constructs and inter-factor construct correlations.

Table 7.39: Correlations between total system usage and system factor constructs and inter-factor construct correlations

		System factors: Administration	System factors: Assessment	System factors: Content	System factors: Student productivity and involvement	System factors: Communication	System factors: Student tracking	System factors: Challenges	Total usage
System factors: Administration	Pearson Correlation	1	.441**	.628**	.495**	.331**	.402**	.148	.187
	Sig. (2-tailed)		.000	.000	.000	.001	.000	.130	.053
	N	107	105	107	107	106	103	106	107
System factors: Assessment	Pearson Correlation	.441**	1	.404**	.526**	.515**	.577**	.191	.214*
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.051	.028
	N	105	106	105	105	105	103	105	106
System factors: Content	Pearson Correlation	.628**	.404**	1	.510**	.433**	.403**	.205*	.199*
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.035	.040
	N	107	105	107	107	106	103	106	107
System factors: Student productivity and involvement	Pearson Correlation	.495**	.526**	.510**	1	.503**	.581**	.187	.304**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.055	.001
	N	107	105	107	107	106	103	106	107
System factors: Communication	Pearson Correlation	.331**	.515**	.433**	.503**	1	.364**	.141	.474**
	Sig. (2-tailed)	.001	.000	.000	.000		.000	.149	.000
	N	106	105	106	106	107	102	106	107

System factors: Student tracking	Pearson Correlation	.402**	.577**	.403**	.581**	.364**	1	.296**	.204*
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.003	.038
	N	103	103	103	103	102	103	102	103
System factors: Challenges	Pearson Correlation	.148	.191	.205*	.187	.141	.296**	1	.082
	Sig. (2-tailed)	.130	.051	.035	.055	.149	.003		.404
	N	106	105	106	106	106	102	107	107
Total usage	Pearson Correlation	.187	.214*	.199*	.304**	.474**	.204*	.082	1
	Sig. (2-tailed)	.053	.028	.040	.001	.000	.038	.404	
	N	107	106	107	107	107	103	107	108
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is significant at the 0.05 level (2-tailed).									

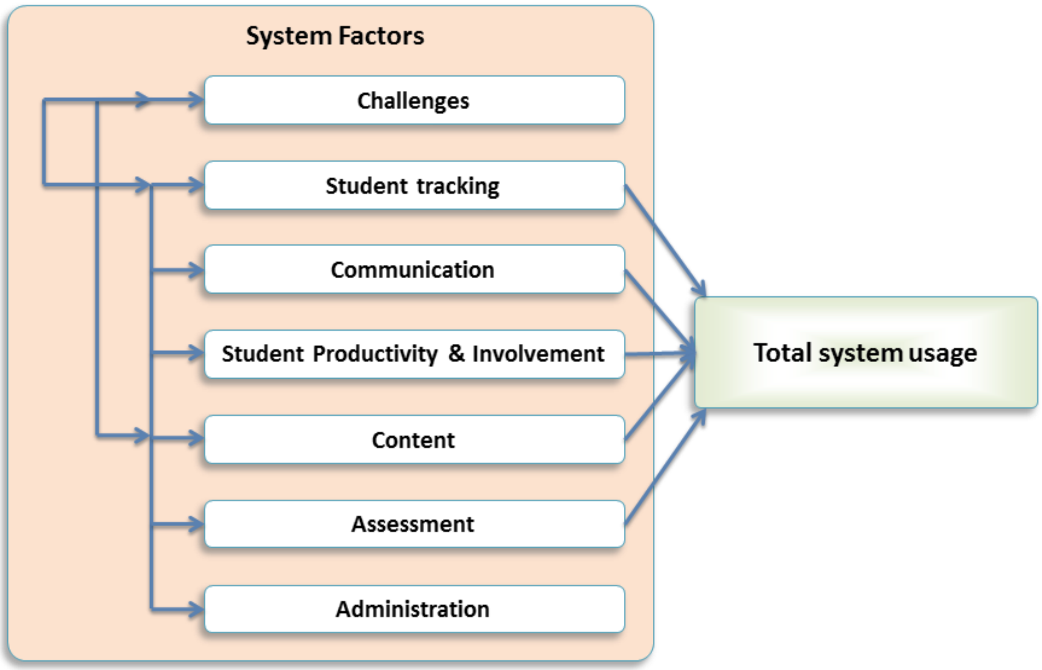

Figure 7.13: Relationships among system factors: functions/features and between system factors and total system usage

The arrows in Figure 7.13 represent the following correlations among the system factors and between system factors and total system usage:

Assessment	→	Total system usage
Content	→	Total system usage
Student involvement and productivity	→	Total system usage
Communication	→	Total system usage
Student tracking	→	Total system usage
Administration	→	Assessment
Administration	→	Content
Administration	→	Student involvement and productivity
Administration	→	Communication
Administration	→	Student tracking
Challenges	→	Content
Challenges	→	Student tracking

7.9.2 Correlation between total system usage and constructs of pedagogic factors

Table 7.40 and Figure 7.14 depict the relationships between total system usage and the pedagogic factors and inter-factor construct correlations.

Table 7.40: Correlations between total system usage and pedagogic factors and inter-factor correlations

		Pedagogic factors: Pedagogic features	Pedagogic factors: Characteristics of online teaching	Pedagogic factors: Challenges	Total usage
Pedagogic factors: Pedagogic features	Pearson Correlation	1	.508**	.206*	.095
	Sig. (2-tailed)		.000	.032	.326
	N	108	108	108	108
Pedagogic factors: Characteristics of online teaching	Pearson Correlation	.508**	1	-.041	.370**
	Sig. (2-tailed)	.000		.675	.000
	N	108	108	108	108
Pedagogic factors: Challenges	Pearson Correlation	.206*	-.041	1	-.135
	Sig. (2-tailed)	.032	.675		.162
	N	108	108	108	108
Total usage	Pearson Correlation	.095	.370**	-.135	1
	Sig. (2-tailed)	.326	.000	.162	
	N	108	108	108	108

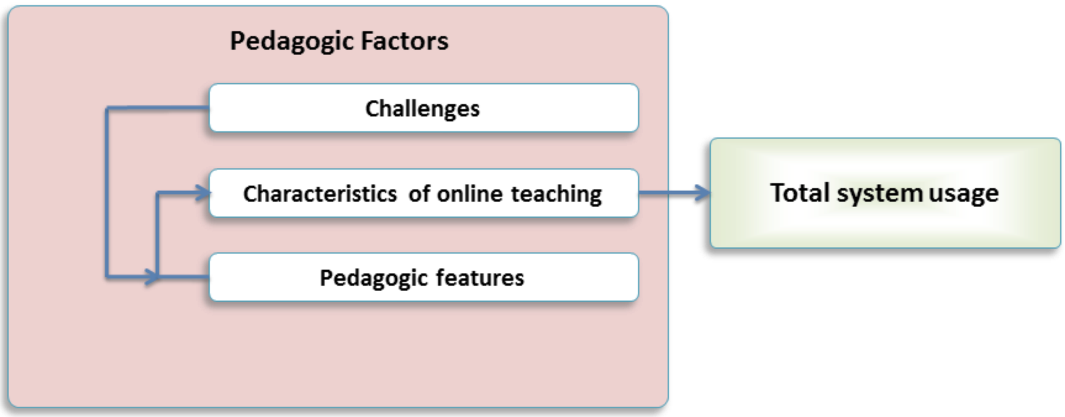

Figure 7.14: Relationships among pedagogic factors and between pedagogic factors and total system usage

The arrows in Figure 7.14 represent the following correlations among the pedagogic factors, and between pedagogic factors and total system usage:

Characteristics of online teaching	→	Total system usage
Pedagogic features	→	Characteristics of online teaching
Challenges	→	Pedagogic features

7.9.3 Correlation between total system usage and constructs of the organisational factor

Table 7.41 and Figure 7.15 depict the relationships between total system usage and the organisational factor constructs and inter-factor construct correlations.

Table 7.41: Correlations between actual system usage and organisational factor constructs and inter-factor class correlations

		Organisational factors: Challenges	Organisational factors: e-learning support	Total usage
Organisational factors: Challenges	Pearson Correlation	1	.449**	.057
	Sig. (2-tailed)		.000	.559
	N	108	108	108
Organisational factors: e-learning support	Pearson Correlation	.449**	1	.077
	Sig. (2-tailed)	.000		.426
	N	108	108	108
Total usage	Pearson Correlation	.057	.077	1
	Sig. (2-tailed)	.559	.426	
	N	108	108	108

**. Correlation is significant at the 0.01 level (2-tailed).

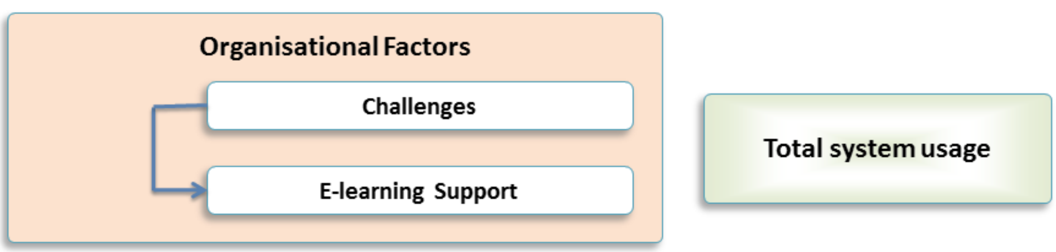

Figure 7.15: Relationships among organisational factors and between organisational factors and total system usage

The arrow in Figure 7.15 represents the following correlations among organisational factors:

Challenges → E-learning support

There is no correlation between organisational factors and total system usage.

7.9.4 Correlation between total system usage and constructs of user difference factors

Sub-sections 7.9.4.1, 7.9.4.2, and 7.9.4.3 describe the correlation between total system usage and the user difference factor constructs.

7.9.4.1 Correlations between total system usage and user difference factor constructs

Table 7.42 and Figure 7.16 depict the relationships between total system usage and the user difference factor constructs and inter-factor construct correlations.

Table 7.42: Correlations between total system usage and user difference factor constructs and inter-factor class correlations

		User difference factors _Experience of online teaching	User difference factors _Challenges	Total usage
User difference factors: Experience of online teaching	Pearson Correlation	1	-.293**	.316**
	Sig. (2-tailed)		.002	.001
	N	108	106	108
User difference factors: Challenges	Pearson Correlation	-.293**	1	-.030
	Sig. (2-tailed)	.002		.759
	N	106	106	106
Total usage	Pearson Correlation	.316**	-.030	1
	Sig. (2-tailed)	.001	.759	
	N	108	106	108
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 7.42 shows that a high score on usage is correlated with a high score on user difference factors: experience of online teaching. A high score on user difference factors: challenges are correlated with a low score on user difference factors: experience of online teaching.

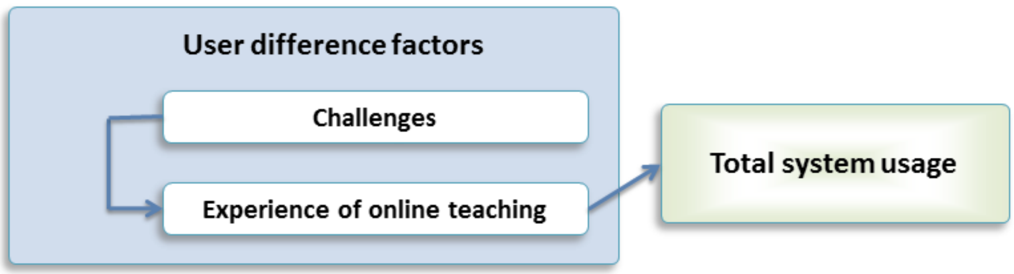

Figure 7.16: Relationships among user difference factors and between user difference factors and total system usage

The arrows in Figure 7.16 represent correlations among user difference factors and between user difference factors and total system usage:

Challenges	→	Experience of online teaching
Experience of online teaching	→	Total system usage

7.9.4.2 Correlation between total system usage and user difference factor construct: comfortable with computer applications

This sub-section describes the correlation between total system usage and the user difference factors: comfortable with computer applications.

Creating spread sheets

The respondents that use Excel have significantly higher total system usage (Mann-Whitney test statistic = 50; p = .039 – **DUT**. Mann-Whitney test statistic = 23; p = .025 – **UKZN**. Mann-Whitney test statistic = 258; p = .016 – **whole sample**).

Word

There is no significant correlation between use of Word and actual system usage.

PowerPoint

There is no significant correlation between use of PowerPoint and actual system usage.

Software creation

There is a significant result for UKZN – Mann-Whitney test statistic = 355; p = .024: The respondents that write programs have higher actual system usage.

7.9.4.3 Correlation between total system usage and user difference factor construct: teaching style preference

The Kruskal-Wallis Test and ANOVA test was done and the result was the same (refer to Appendix 5 for statistics used). There is a significant correlation between teaching style and total system usage. The average usage for blended and online is significantly higher than traditional.

7.10 Correlation between constructs of different factors

This section depicts the correlation between constructs of system and pedagogic factors in Table 7.43 and Figure 7.17; system and organisational factors in Table 7.44 and Figure 7.18 and pedagogic factors and organisational factors in Table 7.45 and Figure 7.19.

Table 7.43: Correlations between system and pedagogic factors

		System factors: Administration	System factors: Assessment	System factors: Content	System factors: Student productivity and involvement	System factors: Communication	System factors: Student tracking	System factors: Challenges	Pedagogic factors: Pedagogic features	Pedagogic factors: Characteristics of online classrooms	Pedagogic factors: Challenges
System factors: Administration	Pearson Correlation	1	.441**	.628**	.495**	.331**	.402**	.148	.292**	.312**	.057
	Sig. (2-tailed)		.000	.000	.000	.001	.000	.130	.002	.001	.561
	N	107	105	107	107	106	103	106	107	107	107
System factors: Assessment	Pearson Correlation	.441**	1	.404**	.526**	.515**	.577**	.191	.154	.247*	.258**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.051	.115	.011	.008
	N	105	106	105	105	105	103	105	106	106	106
System factors: Content	Pearson Correlation	.628**	.404**	1	.510**	.433**	.403**	.205*	.363**	.386**	.158
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.035	.000	.000	.104
	N	107	105	107	107	106	103	106	107	107	107
System factors: Student productivity and involvement	Pearson Correlation	.495**	.526**	.510**	1	.503**	.581**	.187	.239*	.350**	.156
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.055	.013	.000	.108
	N	107	105	107	107	106	103	106	107	107	107
System factors: Communication	Pearson Correlation	.331**	.515**	.433**	.503**	1	.364**	.141	.195*	.304**	.113
	Sig. (2-tailed)	.001	.000	.000	.000		.000	.149	.044	.001	.246
	N	106	105	106	106	107	102	106	107	107	107

System factors: Student tracking	Pearson Correlation	.402**	.577**	.403**	.581**	.364**	1	.296**	.350**	.327**	.223*
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.003	.000	.001	.024
	N	103	103	103	103	102	103	102	103	103	103
System factors: challenges	Pearson Correlation	.148	.191	.205*	.187	.141	.296**	1	.276**	.079	.625**
	Sig. (2-tailed)	.130	.051	.035	.055	.149	.003		.004	.420	.000
	N	106	105	106	106	106	102	107	107	107	107
Pedagogic factors: Pedagogic features	Pearson Correlation	.292**	.154	.363**	.239*	.195*	.350**	.276**	1	.508**	.206*
	Sig. (2-tailed)	.002	.115	.000	.013	.044	.000	.004		.000	.032
	N	107	106	107	107	107	103	107	108	108	108
Pedagogic factors: Characteristics of online classrooms	Pearson Correlation	.312**	.247*	.386**	.350**	.304**	.327**	.079	.508**	1	-.041
	Sig. (2-tailed)	.001	.011	.000	.000	.001	.001	.420	.000		.675
	N	107	106	107	107	107	103	107	108	108	108
	N	107	106	107	107	107	103	107	108	108	108
Pedagogic factors: Challenges	Pearson Correlation	.057	.258**	.158	.156	.113	.223*	.625**	.206*	-.041	1
	Sig. (2-tailed)	.561	.008	.104	.108	.246	.024	.000	.032	.675	
	N	107	106	107	107	107	103	107	108	108	108

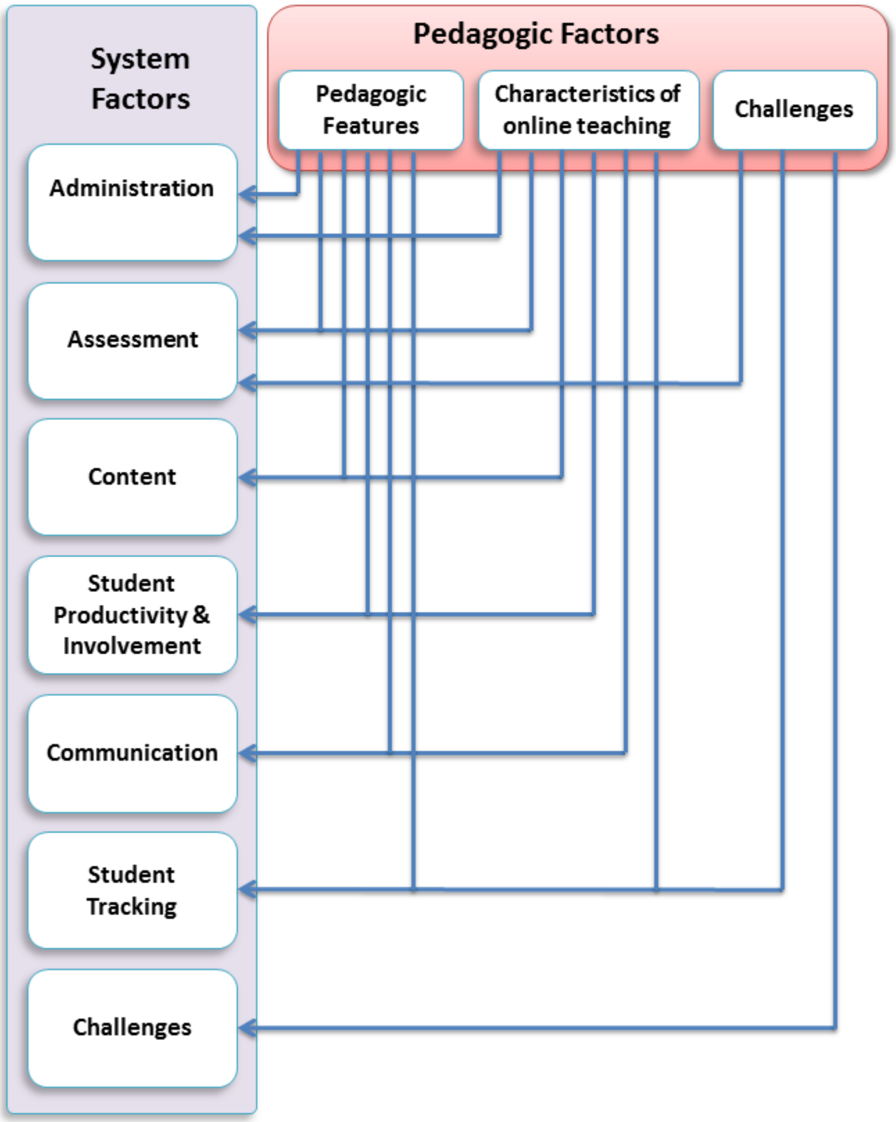

Figure 7.17: Interrelationships between system and pedagogic factors

Table 7.44: Correlations between system and organisational factors

		System factors: Administration	System factors: Assessment	System factors: Content	System factors: Student Productivity and involvement	System factors: Communication	System factors: Student tracking	System factors: Challenges	Organisational factors: e-learning support	Organisational factors: Challenges
System factors: Administration	Pearson Correlation	1	.441**	.628**	.495**	.331**	.402**	.148	.366**	.114
	Sig. (2-tailed)		.000	.000	.000	.001	.000	.130	.000	.242
	N	107	105	107	107	106	103	106	107	107
System factors: Assessment	Pearson Correlation	.441**	1	.404**	.526**	.515**	.577**	.191	.332**	.268**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.051	.001	.006
	N	105	106	105	105	105	103	105	106	106
System factors: Content	Pearson Correlation	.628**	.404**	1	.510**	.433**	.403**	.205*	.394**	.234*
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.035	.000	.015
	N	107	105	107	107	106	103	106	107	107
System factors: Student Productivity and involvement	Pearson Correlation	.495**	.526**	.510**	1	.503**	.581**	.187	.232*	.198*
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.055	.016	.041
	N	107	105	107	107	106	103	106	107	107
System factors: Communication	Pearson Correlation	.331**	.515**	.433**	.503**	1	.364**	.141	.160	.219*
	Sig. (2-tailed)	.001	.000	.000	.000		.000	.149	.099	.023
	N	106	105	106	106	107	102	106	107	107
System factors: Student tracking	Pearson Correlation	.402**	.577**	.403**	.581**	.364**	1	.296**	.350**	.200*

	Sig. (2-tailed)	.000	.000	.000	.000	.000		.003	.000	.043
	N	103	103	103	103	102	103	102	103	103
System factors: Challenges	Pearson Correlation	.148	.191	.205*	.187	.141	.296**	1	.345**	.670**
	Sig. (2-tailed)	.130	.051	.035	.055	.149	.003		.000	.000
	N	106	105	106	106	106	102	107	107	107
Organisational factors: e-learning support	Pearson Correlation	.366**	.332**	.394**	.232*	.160	.350**	.345**	1	.449**
	Sig. (2-tailed)	.000	.001	.000	.016	.099	.000	.000		.000
	N	107	106	107	107	107	103	107	108	108
Organisational factors: Challenges	Pearson Correlation	.114	.268**	.234*	.198*	.219*	.200*	.670**	.449**	1
	Sig. (2-tailed)	.242	.006	.015	.041	.023	.043	.000	.000	
	N	107	106	107	107	107	103	107	108	108
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

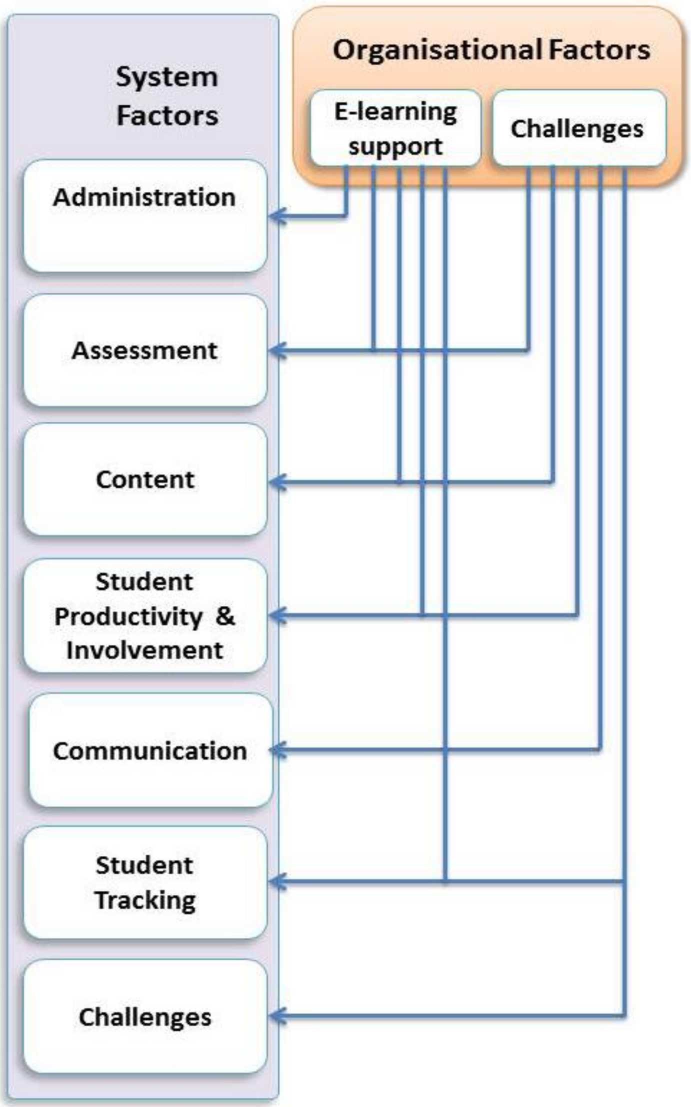

Figure 7.18: Interrelationships between system and organisational factors

Table 7.45: Correlations between pedagogic and organisational factors

		Organisational factors: e-learning support	Organisational factors: Challenges	Pedagogic factors: Pedagogic features	Pedagogic factors: Characteristics of online classrooms	Pedagogic factors: Challenges
Organisational factors: e-learning support	Pearson Correlation	1	.449**	.364**	.415**	.308**
	Sig. (2-tailed)		.000	.000	.000	.001
	N	108	108	108	108	108
Organisational factors: Challenges	Pearson Correlation	.449**	1	.270**	.132	.772**
	Sig. (2-tailed)	.000		.005	.173	.000
	N	108	108	108	108	108
Pedagogic factors: Pedagogic features	Pearson Correlation	.364**	.270**	1	.508**	.206*
	Sig. (2-tailed)	.000	.005		.000	.032
	N	108	108	108	108	108
Pedagogic factors: Characteristics of online classrooms	Pearson Correlation	.415**	.132	.508**	1	-.041
	Sig. (2-tailed)	.000	.173	.000		.675
	N	108	108	108	108	108
Pedagogic factors: Challenges	Pearson Correlation	.308**	.772**	.206*	-.041	1
	Sig. (2-tailed)	.001	.000	.032	.675	
	N	108	108	108	108	108

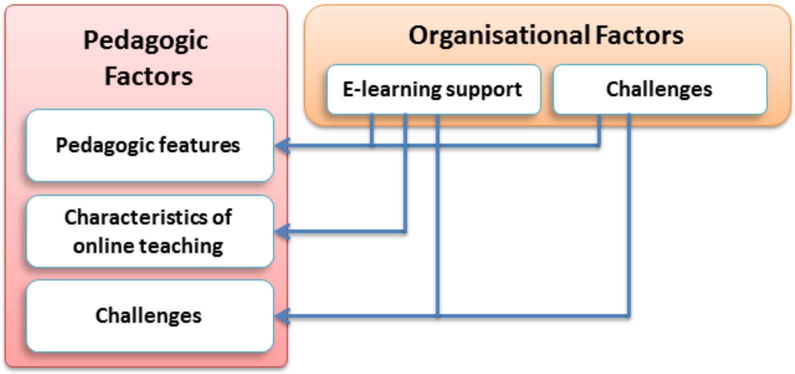

Figure 7.20: Interrelationships between pedagogic and organisational factors

7.11 Correlations between demographic factors and other factors

The following sub-sections describe the correlations between constructs of demographic factors and system, pedagogic, organisational and user difference factors.

7.11.1 Correlation between academic rank and system, pedagogic, organisational and user difference factors

Results show, that for DUT, there is a correlation between user difference factor construct: experience of online teaching and demographic factor: academic rank. Respondents with an academic rank of senior lecturer (3.404) and 'other'(3.444) have greater average scores than associate professor (2.183); (p = 0.013, F = 4.197; df = 3;32). However there is no significant correlation between user difference factor construct: experience of online teaching and demographic factor: academic rank for UKZN or for the total sample.

7.11.2 Correlation between level of study taught and system, pedagogic, organisational and user difference factors

The results show that there is no significant correlation between the demographic factors: level of study and the main four theoretical factors, namely, system, pedagogic, organisational and user difference factors.

7.11.3 Correlation between length of time used and system, factors, pedagogic organisational and user difference factors

Results show a correlation between user difference factor construct: experience of online teaching and demographic factor: length of time used. The average user difference factors: experience of online teaching score for 'less than 1 year (2.733) is significantly less than the user experience score for '1-3 years' (3.248) and '5+years' (3.317).p = 0.019; F = 3.473; df = 3;104.

7.11.4 Correlation between number of courses and system, pedagogic, organisational and user difference factors

Results show a correlation between user difference factors: experience of online teaching and demographic factor: number of courses. The average user difference factors: experience of online teaching score for 'greater than 6' (3.488) is significantly more than the user experience score for '1-3' (3.039).p = 0.002; F =6.692; DF = 2.103.

7.12 Discussion of the findings

Sub-sections 7.12.1 to 7.12.6 present a discussion of the findings in relation to the research questions.

7.12.1 Extent of usage, frequency of usage and usage clusters for VLSs

This section addresses research sub-question 1, namely, 'What is/are the extent of usage, frequency of usage and usage clusters for VLSs in higher education?' The extent or scope of feature usage included all the twenty six functions surveyed with frequency levels ranging from 'not at all', scored at 1, to 'usually' scored at 5. High usage was associated with average frequency scores ('total score') above the neutral score of 3. Low usage was associated with average frequency scores ('total score') below the neutral score of 3. A modest proportion, namely, (ten out of twenty six) or 38.5 % of the VLS functions displayed high usage, while (sixteen out of twenty six) or 61.5% of the VLS functions displayed low usage for the institution DUT, as described in section 7.3.1. The analysis of the 'total score' (average frequency score) of the following functions, namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; e-mail communication; creating lessons; online quizzes/ self-tests; online assignment submission; online threaded discussion forums; and online glossary at the institution DUT shows a higher usage as these scores were above a neutral score of 3.

A small proportion, namely, (five out of twenty six) or 19.2 % of the VLS functions displayed high usage, while (twenty one out of twenty six) or 80.8% of VLS functions display lower than average usage for the institution UKZN as described in section 7.3.2. The analysis of the 'total score' (average frequency score) of the following functions, namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; and e-mail communication at UKZN shows a higher usage as these scores were above a neutral score of 3.

The content usage cluster was used more than the other clusters. Analysis (independent samples t-test) shows that average usage for DUT (2.5955) of the pedagogic cluster namely, 'learning and assessment', is significantly greater than that of UKZN (2.0888), p = 0.007, as discussed in sub-section 7.3.4.2.

The usage groupings or clusters identified were as follows: communication, management, content and pedagogic (in this study defined as learning and assessment), which is depicted in Table 7.19.

The findings of this study confirmed the findings of previous studies, discussed in Yueh and Hsu (2008), where the actual use of VLSs reveal that some functions were used more often than others. Yueh and Hsu (2008:60) reported the findings of a survey of eight hundred and sixty two faculty members at thirty eight institutions who used the Blackboard System. They found that few academics used VLS functions to assess students or to encourage community-based activities. Most academics used instructional functions, such as publishing syllabi, sending email, and distributing reading material. The communicative and interactive features were mostly unused.

7.12.2 System and concomitant factors of perceived usefulness and perceived importance that influence actual system usage

This section addresses research sub-question 2, namely, 'What system factors corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?' The system factors functions /features, corresponding to perceived usefulness that directly influenced actual system usage in the two residential institutions falling within the scope of this study were:

- Assessment
- Content
- Student productivity and involvement
- Communication
- Student tracking.

The findings of this study with regards to the perceived usefulness of instructional functions of a VLS was confirmed by Wyles (2004b) and Botturi (2004). McGill and Klobas (2009) reported that factors such as perceived usefulness influenced VLS use.

This finding supports the proposition: 'Beliefs about the usefulness of the functions/features of the VLS influences actual system usage in higher education.'

The system factors non-functional characteristics corresponding to perceived importance were not correlated with total system usage. However, the system factors non-functional characteristics corresponding to perceived importance were positively correlated with system factors functions/ features corresponding to perceived usefulness. One can thus infer that system factors non-functional characteristics indirectly influenced total system usage. This finding does *not* support the finding of McGill a Klobas (2009), who reported that the strongest influence on student use was the system characteristics.

7.12.3 Pedagogic factors that influence actual system usage

This section addresses research sub-question 3, namely, 'What pedagogic factors influence actual system usage in higher education?' The pedagogic factor construct that was found to directly influence actual system usage in the two residential institutions falling within the scope of this study was characteristics of online teaching. The pedagogic factor constructs pedagogic features were positively correlated with the factor characteristics of online teaching. This implies that they played an indirect role in system usage. This finding confirms an earlier study done by Morgan (2003) who reported that actual system usage allowed faculty to increase communication with their students; gave students access to class documents; provided students the convenience and transparency of the grade book; included more interactive materials in their teaching; increased the amount of feedback and promptness of feedback to students; encouraged students to hold discussions and engage with course materials in a slower paced manner.

This finding supports the proposition: 'Pedagogic factors influenced actual system usage in higher education.'

7.12.4 Organisational factors that influence actual system usage

This section addresses research sub-question 4, namely, 'What organisational factors influence actual system usage in higher education?' The survey results did not show any significant correlation between organisational factor constructs and actual system usage in the two residential institutions falling within the scope of this study. This result did not confirm the qualitative findings and analysis, which demonstrated the influence of organisational factors on actual system usage presented in Chapter 6. However, organisational factors were found to influence system factors corresponding to perceived usefulness and pedagogic factors. The latter two factors were found to directly influence actual system usage. Hence, organisational factors can be inferred to have an indirect influence on total system usage. This finding supports that of McGill and Klobas (2009:499), who reported that facilitating conditions did *not* influence system use, even though it was considered important for the success of e-learning. According to McGill and Klobas (2009:499), “support services have little effect on the ways in which university teachers incorporate” VLSs in their teaching.

This finding *refutes* the proposition: ‘Organisational factors influences actual system usage in higher education.’

7.12.5 User difference factors that influence total system usage

This section addresses research sub-question, 5 namely, ‘What user difference factors influence actual system usage in higher education?’ The user difference factor constructs that were found to directly influence actual system usage in the two residential institutions falling within the scope of this study were experience of online teaching; comfort with spread sheets and programming computer application; and teaching style preference. This finding supports the finding of Al-Busaidi and Al-Shihi (2010), who reported a significant effect of computer self-efficacy on instructors' acceptance of an e-learning system. Experience with the use of technology (EUT) was found to play a major role with the acceptance of technology (Al-Busaidi & Al-Shihi, 2010). The role of the instructor’s teaching style on system use was confirmed by Al-Busaidi and Al-Shihi (2010).

This finding supports the proposition: ‘User difference factors influenced actual system usage in higher education.’

7.12.6 Demographic factors that influence total system usage

This section addresses research sub-question 6, namely, ‘What demographic factors influence actual system usage in higher education?’ The demographic factor constructs that were found to directly influence actual system usage in the two residential institutions falling within the scope of this study were:

- Length of usage
- Number of online or hybrid courses taught

- Level of study.

The correlation between the demographic factor ‘length of usage’ and actual system usage was low to medium in the cluster analysis performed on the qualitative data reported in Chapter 6. The survey findings confirmed the correlation between this demographic factor and actual system usage. This finding supports the finding of Oliver and Moore (2008) who reported that experience may play an important role in the web tools that faculty employ as the faculty trend was to add tools to their repertoire.

In addition, there was a correlation between the demographic factor constructs: length of usage (DUT and UKZN); number of courses taught (DUT and UKZN); and academic rank (DUT only) and the user difference factor construct: experience of online teaching.

The positive relationship between system experience and total system usage was an additional finding in the qualitative study, which was verified in this survey. The positive relationship between ‘level of study’ and total system usage was an additional finding from the quantitative study using surveys.

7.13 Summary

This chapter reported on the results of the quantitative data collected from the survey administered at DUT and UKZN. The findings of this chapter confirm the theory that technical functions of a VLS alone do not influence actual system usage in higher education (Markus, 1983). Socio-technical factors (Markus, 1983), in the form of pedagogic factors, user difference factors (Markus, 1983) and demographic factors, also play a major role in influencing actual system usage in higher education. The results of this chapter together with Chapter 6 are used to propose a conceptual model on the factors influencing actual system usage in higher education, which is discussed in the following chapter.

CHAPTER 8: PROPOSED MODEL

8.1 Introduction

This chapter integrates the empirical findings of the primary sources of data obtained via interviews discussed in Chapter 6 (qualitative analysis), and surveys discussed in Chapter 7 (quantitative analysis) together with the secondary data obtained via the literature review discussed in Chapters 2, 3 and 4. The main purpose of this chapter is to propose a conceptual model representing the factors that influence virtual learning system usage in higher education.

This research study was guided by the main research question, namely:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

In order to address the main research question, the following research sub-questions were included:

1. What is/are the extent of usage, frequency of usage, total system usage, and usage clusters for VLSs in higher education?
2. What *system factors* corresponding to concomitant factors of *perceived usefulness* and *perceived importance* influence *actual system usage* in higher education?
3. What *pedagogic factors* influence *actual system usage* in higher education?
4. What *organisational factors* influence *actual system usage* in higher education?
5. What *user difference factors* influence *actual system usage* in higher education?
6. What *demographic factors* influence *actual system usage* in higher education?

The findings or results of the survey for the six research sub-questions were discussed in Chapter 7, section 7.12. In section 8.2 of this chapter, the main research question and the six research sub-questions are reviewed and discussed within the context of the empirical study (interviews and surveys) and compared to the literature on factors influencing *actual system usage*. Section 8.3 discusses the proposed model, its components and relationships between the components and between the factors. Section 8.4 describes the method for using the proposed conceptual model VLSUM by managers/directors of e-learning/educational technology departments and instructional designers and educational technologists. Section 8.5 provides a summary of the chapter.

8.2 Review of the qualitative and quantitative findings

In this section, the findings from the research questions presented in Chapters 1 and 5 are summarised. In section 8.2.1, the combined qualitative and quantitative findings for the first research sub-question is presented, namely, the extent of usage, frequency of usage, total system usage and usage clusters for VLSs.

Section 8.2.2 presents the combined empirical and literature findings for the second research sub-question on the correlations between (a) *system factors*: *functions/features* corresponding to the *perceived usefulness* factor and *actual system usage* and (b) *system factors: non-functional characteristics* corresponding to the perceived importance factor and *actual system usage*. Section 8.2.3 presents the combined empirical and literature findings for the third research sub-question on the correlations between *pedagogic factors* and *actual system usage*. Section 8.2.4 presents the combined empirical and literature findings for the fourth research sub-question on the correlations between *organisational factors* and *actual system usage*. Section 8.2.5 presents the combined empirical and literature findings for the fifth research sub-question on the correlations between *user difference factors* and *actual system usage*. Section 8.2.6 presents the combined empirical and literature findings for the sixth research sub-question on the correlations between *demographic factors* and *actual system usage*. A positive correlation with *actual system usage* means that high usage was correlated with strong agreement to statements pertaining to each of the above-listed factors.

8.2.1 Actual system feature usage extent, feature usage frequency, and usage clusters

In this section, the first research sub-question is answered, namely, ‘What is/are the extent of usage, frequency of usage, total system usage, and usage clusters for VLSs in higher education?’ A Cronbach alpha of .912 was obtained when all the usage items for question 15 of the questionnaire (refer to Appendix 2) were combined. In statistics, Cronbach’s alpha is a coefficient of internal consistency (reliability). Reliability means that a scale should consistently reflect the construct it is measuring (Field, 2009).

The extent or scope of feature usage included all the twenty six functions surveyed with frequency levels ranging from ‘not at all’ scored at 1 to ‘usually’ scored at 5. High frequency usage of *system factors*: *functions/features* was associated with a ‘total score’ (i.e., average frequency score) above the neutral score of 3. Low frequency usage of *system factors*: *functions/ features* was associated with a ‘total score’ (i.e., average frequency score) below the neutral score of 3.

The feature usage extent and feature usage frequency for DUT are depicted in Table 7.16 and Figure 7.6. Analysis of the ‘total score’ (average frequency score) of the following *system factors*: *functions/ features,* namely posting course content; presenting course information; course announcements or notices/news; course calendar and schedule; e-mail communication; creating lessons; online quizzes/ self-tests; online assignment submission; online threaded discussion forums; and online glossary showed high frequency usage as these scores were above a neutral score of 3. Analysis of the ‘total score’ (average frequency score) of the following *system factors*: *functions/ features* namely online marking of assessments/ activities with grading and comments; online tests; peer evaluation of assignments; tracking student participation in online discussion forums; grading student participation in online discussion forums; peer reviews of student posts; grading of peer reviews; publishing marks in grade book; online real time chat with students; wikis; blogs; shared whiteboard; file exchanges; student online journals; online surveys and online polls showed low frequency usage as these scores were below a neutral score of 3. The percentage of *system factors*: *functions/ features* that displayed high frequency usage was 38.5 % (i.e., ten out of twenty six), while 61.5% (i.e., sixteen out of twenty six) displayed low frequency usage for the institution DUT.

The feature usage extent and feature usage frequency for UKZN is depicted in Table 7.17 and Figure 7.7. Analysis of the ‘total score’ (average frequency score) of the following *system factors*: *functions/ features,* namely, posting course content; presenting course information; course announcements/notices/news; course calendar and schedule; and e-mail communication showed a high frequency usage as these scores were above a neutral score of 3. Analysis of the ‘total score’ (average frequency score) of the following *system factors*: *functions/features,* namely, online assignment submission; online marking of assessments/ activities with grading and comments; online quizzes/ self-tests; online tests; peer evaluation of assignments; tracking student participation in online discussion forums; grading student participation in online discussion forums; peer reviews of student posts; grading of peer reviews; publishing marks in grade book; online threaded discussion forums; online real time chat with students; wikis; blogs; shared whiteboard; file exchanges; student online journals; creating lessons; online glossary; online surveys and online polls showed a low frequency usage as these scores were below a neutral score of 3. The percentage of *system factors*: *functions/ features* that displayed high frequency usage was 19.2 % % (i.e., five out of twenty six), while 80.8 % (i.e., twenty one out of twenty six) displayed low frequency usage for the institution UKZN.

The usage clusters derived from survey findings were communication, management, pedagogic, and content. The usage clusters corresponding to the usage items for question 15 in the questionnaire (refer to Appendix 2) is depicted in Table 7.19. The Cronbach’s alpha values for the whole sample and for the institutions DUT and UKZN separately based on the survey responses received were, on the whole, more than 0.7, which was acceptable for analysis. The average usage scores for the four usage clusters, namely, the communication cluster, management cluster, pedagogic cluster and content cluster are depicted in Tables 7.20 and 7.21. Higher average usage scores implied higher frequency of usage. The content cluster was used more than the other clusters for the institutions DUT and UKZN meaning that content functions/features enjoyed high usage by educators at both DUT and UKZN. An analysis using an independent samples t-test showed that average system usage for DUT (2.6) of the pedagogic cluster was significantly greater than that of UKZN (2.0), $p = 0.007$. This means that educators at DUT were using more of the pedagogic *functions/ features* than their counterparts at UKZN. There was no significant difference in the average score for the communication cluster for the institutions DUT and UKZN. A rounded off average score of 3 was obtained for the communication cluster meaning that educators at both DUT and UKZN were making moderate usage of communication *functions/ features*. There was no significant difference in the average score for the management cluster for the institutions DUT and UKZN. Average scores of 2.2 and 2.1 obtained for DUT and UKZN, respectively, implied that management *functions/features* enjoyed lower frequency of usage.

8.2.2 The influence of concomitant factors namely system factors, perceived usefulness and perceived importance on actual system usage

In this section, the second research sub-question is answered, namely, 'What system factors corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?' This sub-section examines the correlations between:

- *System factors*: *functions/features* corresponding to perceived usefulness and *actual system usage.*
- *System factors: challenges* and *actual system usage.*
- *System factors: non-functional characteristics* corresponding to perceived importance and *actual system usage*.

8.2.2.1 The influence of concomitant factors: system factors and perceived usefulness

The cluster analysis of interview findings confirmed that *perceived usefulness* corresponding to the following *system factors*: *functions/features* were positively correlated with *actual system usage*:

- Assessment
- Content
- Administration/management
- Communication
- Student productivity and involvement

- Student tracking.

Analysis of the survey findings showed that the mean scores of agreement with *perceived usefulness* corresponding to *system factors*: *functions/ features* were all significantly above a neutral score of 3. This demonstrated that there was significant agreement amongst educators on the *perceived usefulness* of *system factors*: *functions/ features,* as illustrated in Figure 7.9.

The Pearson Product correlation analysis of survey findings indicated the following positive correlations between *perceived usefulness* corresponding to *system factors*: *functions/ features* and *actual system usage*:

Assessment	→	*Actual system usage*
Content	→	*Actual system usage*
Student productivity and involvement	→	*Actual system usage*
Communication	→	*Actual system usage*
Student tracking	→	*Actual system usage*

While the survey findings did *not* verify a positive correlation between *perceived usefulness* corresponding to *systems factors*: *functions/features* of administration and *actual system usage*, this function was positively correlated with *perceived usefulness* corresponding to the other *system factors*: *functions/ features* of assessment, content, student productivity and involvement, communication and student tracking that directly influenced *actual system usage*. This means that strong agreement to statements on *perceived usefulness* corresponding to systems factors: *functions/ features* of administration was related to strong agreement on statements related to the *perceived usefulness* corresponding to other *system factors*: *functions/ features*. As *systems factors*: *functions/ features* were found to influence each other; it can be argued that they indirectly influence all relations of those functions. One can thus assume that *perceived usefulness* corresponding to *system factors*: *functions/ features* of administration indirectly influenced *actual system usage*. The Pearson Product correlation analysis of survey findings indicated the following positive correlations of *perceived usefulness* corresponding to the *system factors*: *functions/ features*:

Administration	→	Assessment
Administration	→	Content
Administration	→	Student productivity and involvement
Administration	→	Communication
Administration	→	Student tracking

8.2.2.2 The influence of system factors: challenges

Challenges were identified as a subtheme of the *system factors* category in the interview findings. Analysis of the survey findings showed that the mean scores of agreement with *system factors: challenges* were all significantly above a neutral score of 3. However, the Pearson Product correlation analysis of survey findings indicated that the *system factors: challenges* were not statistically correlated with *actual system usage* but rather positively correlated with other *system factors*: *functions/ features* that directly influenced *actual system usage*. This means that strong agreement to statements on *system factors: challenges* were related to strong agreement on statements related to *perceived usefulness* corresponding to *system factors*: *functions/ features*. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *system factors: challenges* indirectly influenced *actual system usage*.

The following positive correlations were identified between *system factors: challenges* and *perceived usefulness* corresponding to the *system factors*: *functions/ features*:

System challenges → Content
System challenges → Student tracking

In summary, the overall positive correlation between *perceived usefulness* corresponding to *system factors*: *functions/ features* and *actual system usage* means that high system usage reported by educators was correlated with strong agreement by educators to statements pertaining to *perceived usefulness* corresponding to *system factors*: functions/features. Furthermore, it is assumed that *system factors: challenges* indirectly influenced *actual system usage* in view of its correlation with *perceived usefulness* corresponding to *system factors*: *functions/ features*.

The findings of this study with regards to the *perceived usefulness* of instructional functions of a VLS supported the findings of Martin (2008); Barron (2003); Wyles (2004b);and Botturi (2004)**.** According to McGill and Klobas (2009), factors such as *perceived usefulness* have been found to influence VLS use.

8.2.2.3 The influence of concomitant factors: system factors and perceived importance

The cluster analysis of interview findings confirmed that *perceived importance* corresponding to *system factors: non-functional characteristics* were positively correlated with *actual system usage* in terms of:

- Flexibility
- Security
- Reliability
- Usability
- Performance

- Standards compliance.

Analysis of the survey findings showed that the mean scores of agreement with *perceived importance* corresponding to *system factors: non-functional characteristics* were significantly above a neutral score of 3. However, the Pearson Product correlation analysis of survey findings did *not* confirm a positive correlation between *perceived importance* corresponding to *system factors: non-functional characteristics* and *actual system usage*. Instead the Pearson Product correlation analysis of survey findings confirmed the following correlations between *perceived importance* corresponding to *system factors: non-functional characteristics* and *perceived usefulness* corresponding to *system factors*: *functions/features*:

Non-functional characteristics	→	Administration
Non-functional characteristics	→	Assessment
Non-functional characteristics	→	Content
Non-functional characteristics	→	Communication
Non-functional characteristics	→	Student productivity and involvement
Non-functional characteristics	→	Student tracking

Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *perceived importance* corresponding to system factors: non-functional characteristics indirectly influenced *actual system usage*.

In summary, the finding of *no* overall positive correlation between *perceived importance* corresponding to system factors: non-functional characteristics and *actual system usage* means that high system usage reported by educators was *not* correlated with strong agreement by educators to statements pertaining to *perceived importance* corresponding to *system factors: non-functional characteristics*. This means that, while educators believe non-functional characteristics of a system are important, this does not directly influence *actual system usage*. However, it is assumed that *perceived importance* corresponding to system factors: non-functional characteristics indirectly influenced *actual system usage* in view of its positive correlation with *system factors*: functions/features.

The finding on *system factors: non-functional characteristics* did not support the finding by McGill and Klobas (2009) who reported that system characteristics strongly influenced use.

8.2.3 The influence of pedagogic factors on actual system usage

In this section, the third research sub-question is answered, namely, 'What pedagogic factors influence actual system usage in higher education?' This sub-section summarises the correlations between the following *pedagogic factors* and *actual system usage*:

- Pedagogic features
- Characteristics of online teaching
- Challenges.

The cluster analysis of interview findings identified *pedagogic factors* as influential comprising the following: pedagogic features, characteristics of online teaching and challenges.

Analysis of the survey findings showed that the mean scores of agreement with *pedagogic factors* were significantly above a neutral score of 3. The cluster analysis of interview findings showed a positive correlation between *pedagogic factors* and *actual system usage*. The survey findings confirmed this correlation and a fine grained analysis indicated that *pedagogic factors*: characteristics of online teaching were positively correlated with *actual system usage*. However, *pedagogic factors*: pedagogic features were positively correlated with *pedagogic factors*: characteristics of online teaching. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *pedagogic factors*: pedagogic features indirectly influenced *actual system usage*.

In addition, challenges were identified as a sub theme of the *pedagogic factor* category in the interview findings. Analysis of the survey findings showed that the mean scores of agreement with *pedagogic factors*: challenges were significantly above a neutral score of 3. However, survey findings did *not* show a correlation between *pedagogic factors*: challenges and *actual system usage*. Instead a positive correlation was found between *pedagogic factors*: challenges and *pedagogic factors*: pedagogic features. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *pedagogic factors*: challenges indirectly influenced *actual system usage*. In addition, there was a positive correlation between *pedagogic factors* and (a) *perceived usefulness* corresponding to *system factors: functions/ features* (b) *perceived importance* corresponding to *system factors*: non-functional characteristics. This means that strong agreement to statements pertaining to *pedagogic factors* was correlated with strong agreement to statements pertaining to *perceived usefulness* corresponding to *systems factors*: *functions/ features* and statements pertaining to *perceived importance* corresponding to *system factors: non-functional characteristics*.

The Pearson Product correlation analysis of survey findings confirmed the following correlations among *pedagogic factors*, between *pedagogic factors* and *actual system usage* and between *pedagogic factors* and other *influential factors*:

Challenges	→	Pedagogic features
Pedagogic features	→	Characteristics of online teaching
Characteristics of online teaching	→	*Actual system usage*
Pedagogic factors functions/ features	→	*Perceived usefulness* corresponding to *System factors*
Pedagogic Factors non-functional characteristics	→	*Perceived importance* corresponding to *System factors:*

In summary, the positive correlation between *pedagogic factors*: characteristics of online teaching and *actual system usage* means that high system usage reported by educators was correlated with strong agreement by educators to statements pertaining to *pedagogic factors*: characteristics of online teaching. In addition, it is assumed that *pedagogic factor*: pedagogic features indirectly influenced *actual system usage* in view of its positive correction with *pedagogic factors*: characteristics of online teaching and *pedagogic factors*: challenges indirectly influenced *actual system usage* in view of its positive correction with *pedagogic factors*: pedagogic features.

This finding on the influence of the *pedagogic factors*: characteristics of online teaching on *actual system usage* confirms an earlier study done by Morgan (2003) who reported that VLS use allowed faculty to increase communication with their students; give students access to class documents; provide students the convenience and transparency of the grade book; include more interactive materials in their teaching; increase the amount of feedback and promptness of feedback to students; get students to hold discussions and engage with course materials in a slower paced manner.

8.2.4 The influence of organisational factors on actual system usage

In this section, the fourth research sub-question is answered, namely, 'What organisational factors influence actual system usage in higher education?' This sub-section summarises the correlations between the following *organisational factors* and *actual system usage*:

- E-learning support
- Challenges.

And the correlations with the *organisational factors* component:

- E-learning support and Challenges
- *Organisational factors* and other *Influential factors*.

The cluster analysis of interview findings identified *organisational factors* as influential comprising the following: e-learning support and challenges.

Analysis of the survey findings showed that the mean scores of agreement with *organisational factors* were significantly above a neutral score of 3. The cluster analysis of interviews showed that *organisational factors* were positively correlated with *actual system usage*. The survey findings, however, did not confirm this correlation. However, the *organisational factors*: e-learning support was positively correlated to (a) *perceived usefulness* corresponding to system factors: *functions/features*; (b) *perceived importance* corresponding to *system factors: non-functional characteristics* and *pedagogic factors*. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *organisational factors*: e-learning support indirectly influenced *actual system usage*.

In addition, *organisational factors*: challenges were identified as a subtheme of the organisational factor category in the interview findings. Analysis of the survey findings showed that the mean scores of agreement with *organisational factors*: challenges were significantly above a neutral score of 3. However, survey findings indicated that *organisational factors*: challenges were not statistically correlated with *actual system usage* but were positively correlated with *organisational factors*: e-learning support. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume that *organisational factors*: challenges indirectly influenced *actual system usage*.

The Pearson Product correlation analysis of survey findings confirmed the following correlations between *organisational factors* and between *organisational factors* and other *influential factors*:

Organisational Factors: Challenges → *Organisational Factors*: e-learning Support
Organisational Factors: e-learning Support → *Perceived usefulness* corresponding to System factors: *Functions/Features*
Organisational Factors: e-learning Support → Perceived-importance corresponding to System factors: Non-functional characteristics
Organisational Factors: e-learning Support → *Pedagogic Factors*

In summary, the finding of *no* overall positive correlation between *organisational factors* and *actual system usage* means that high system usage reported by educators was *not* correlated with strong agreement by educators to statements pertaining to *organisational factors*. This means that while educators agreed with statements pertaining to *organisational factors*: e-learning support and statements pertaining to *organisational factors*: challenges, these factors did not directly influence *actual system usage*. However, it is assumed that organisational factor: e-learning support indirectly influenced *actual system usage* in view of its positive correlation with *perceived usefulness* corresponding to *system factors: functions/features*, and *pedagogic factors*. Furthermore, it is assumed that organisational factor: challenges indirectly influenced *actual system usage* in view of its correlation with *organisational factors*: e-learning support.

This finding supports the finding of McGill and Klobas (2009:499) who reported that facilitating conditions did not influence use, even though it was considered important for the success of e-learning. According to McGill, Klobas and Renzi (2008:653), "support services have little effect on the ways in which university teachers incorporate" VLS in their teaching.

8.2.5 The influence of user difference factors on actual system usage

In this section, the fifth research sub-question is answered, namely, 'What user difference factors influence actual system usage in higher education?' This sub-section summarises the correlations between the following *user difference factors* and *actual system usage*:

- Computer comfort level
- Teaching style preference
- Experience of online teaching
- Challenges.

The cluster analysis of interview findings identified *user difference factors* as influential comprising the following: computer comfort level, teaching style preference, experience of online teaching and challenges.

Analysis of the survey findings showed that the mean scores of agreement with the *user difference factors* were significantly above a neutral score of 3. The cluster analysis of interviews showed that *user difference factors* were positively correlated with *actual system usage*. The survey findings confirmed this correlation and a fine grained analysis showed the following correlations between *user difference factors* and *actual system usage*:

Teaching style preference → *Actual system usage*

Experience of online teaching	→	*Actual system usage*
Computer comfort level: use of spread sheets	→	*Actual system usage*
Computer comfort level: software creation	→	*Actual system usage*

In addition, *user difference factors*: challenges were identified as a sub theme of the *user difference factors* category in the interview findings. Analysis of the survey findings showed that the mean scores of agreement with the *user difference factors*: challenges were significantly above a neutral score of 3. However, survey findings indicate that *user difference factors*: challenges were not statistically correlated with *actual system usage* but rather negatively correlated with *user difference factors*: experience of online teaching. This means that a high score on *user difference factors*: challenges was correlated with a low score on *user difference factors*: experience of online teaching from which we can infer a low positivity towards online teaching. Using the argument that if factors are found to influence other factors, then they indirectly influence all relations of those factors, one can thus assume, that *user difference factors*: challenges indirectly influenced *actual system usage*.

In summary, the finding of positive correlation between *user difference factors* and *actual system usage* means that *actual system usage* was correlated with statements pertaining to *user difference factors*. This means that high system usage reported by educators was correlated with strong agreement to statements pertaining to *user difference factors*: experience of online teaching. In other words, a high score for 'experience of online teaching' indicated positivity towards online teaching, which influenced *actual system usage*. Further, it was found that higher system usage was correlated with educators that use/create spreadsheets and those who can write programs meaning that educators who have a higher level of computer comfort and experience show higher usage. Finally, the average system usage for blended and online teaching style preference was significantly higher than for the traditional teaching style preference, meaning that educators with a blended and online teaching style preference showed higher usage. It is also assumed that *user difference factors*: challenges indirectly influenced *actual system usage* in view of its negative correlation with *user difference factors*: experience of online teaching.

These findings were supported by Al-Busaidi and Al-Shihi (2010) who reported a significant effect of computer self-efficacy on instructors' acceptance of an e-learning system. In addition, experience with the use of technology (EUT) was found to play a major role with the acceptance of technology (Al-Busaidi &Al-Shihi, 2010). The role of the instructor's teaching style was also found to be a determining factor in system usage, as discussed in Al-Busaidi and Al-Shihi (2010).

8.2.6 The influence of demographic factors on actual system usage

In this section, the sixth research sub-question is answered, namely, 'What demographic factors influence actual system usage in higher education?' This sub-section summarises the correlations between the following *demographic factors* and *actual system usage*:

- System experience
- Level of study.

The cluster analysis of interview findings identified *demographic factors: system experience* as influential as this factor was positively correlated with *actual system usage*. The survey findings confirmed this correlation and a fine grained analysis showed the following correlations between *demographic factors* and *actual system usage* and other influential factors:

Demographic factors: system experience	→	*Actual system usage*
Demographic factors: level of study	→	*Actual system usage*
Demographic factors	→	*User difference factors*

In summary, the finding of positive correlation between *demographic factors* and *actual system usage* means that system usage is correlated with statements pertaining to system experience and level of study. This means that total system usage reported by educators was correlated with length of usage of the system in years and the number of courses taught which collectively measured the system experience of educators. In addition, the positive correlation between system usage and level of study means that those educators who lectured mostly postgraduate and some undergraduate had higher usage than those who lectured mostly undergraduate and some post-graduate as well as those who lectured only undergraduate or only postgraduate.

Survey findings also indicated that *demographic factors*: system experience was positively correlated with user difference factors: experience of online teaching. There was a correlation between total system usage and length of usage in years as well as a correlation between total usage and number of courses taught. *Demographic factors*: system experience represents a combination of the variables: length of usage and number of online courses taught. Educators with higher years of usage showed higher levels of utilisation of *functions/ features* and educators that taught more than six online/hybrid courses showed higher levels of utilisation of *functions/features*. This means more system experience (in number of years of usage and number of course taught) was correlated with strong agreement to statements measuring experience of online teaching (in other words, positivity towards online teaching). The statements measuring experiences of online teaching were, namely, comfort, effectiveness, effort, and communication ease.

This finding was supported by Oliver and Moore, (2008) who reported that experience may play an important role in the web tools faculty employ as the faculty trend was to add tools to their repertoire.

8.3 Proposed Model

At this juncture in the study, knowledge gleaned from the different sources have been collected and analysed (in Chapters 6 and 7) and the combined empirical findings were discussed in section 8.2. These findings include qualitative data gathered from interviews and quantitative data gathered from surveys. These empirical findings are integrated with literature review findings with particular reference to models for ACTUAL SYSTEM USAGE in an attempt to answer the main research question of this study, namely:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

The body of knowledge produced from this research is integrated and presented as the Virtual Learning System Usage Model (VLSUM). VLSUM was developed using a combination of different system acceptance and usage models, namely TRA, TPB, TAM/TAM2; UTAUT, task-technology fit, innovation diffusion, systems-determined, interaction and people-determined theories, as well as the empirical results of this study.

The three main distinguishing components of VLSUM are the SYSTEM FACTORS, INFLUENTIAL FACTORS, and ACTUAL SYSTEM USAGE.

- The SYSTEM FACTORS component (refers to virtual learning systems) that influences the ACTUAL SYSTEM USAGE component (refers to system feature usage, usage clusters and total system usage), as illustrated in Figure 8.1, comprises the following:
  - *Functions/ Features*
  - *Non-functional Characteristics*
  - *Challenges*.

- The INFLUENTIAL FACTORS component (refers to factors having or exercising influence) that influences the ACTUAL SYSTEM USAGE component, as illustrated in Figure 8.1, comprises the following:
  - *Perceived Usefulness*
  - *Perceived Importance*
  - *Pedagogic Factors*
  - *Organisational Factors*
  - *User Difference Factors*
  - *Demographic Factors.*
- The ACTUAL SYSTEM USAGE component, as illustrated in Figure 8.1, comprises the following:
  - *Total System Usage*
  - *Feature Usage Extent*
  - *Feature Usage Frequency*
  - *Usage Clusters*.

In sub-section 8.3.1, the SYSTEM FACTORS component of the proposed model VLSUM is described in more detail followed by a detailed description of the INFLUENTIAL FACTORS component in sub-section 8.3.2. In sub-section 8.3.3, a detailed description of the ACTUAL SYSTEM USAGE component is provided followed by a discussion on the relationships between the components of VLSUM in sub-section 8.3.4. Section 8.4 describes the method for using VLSUM.

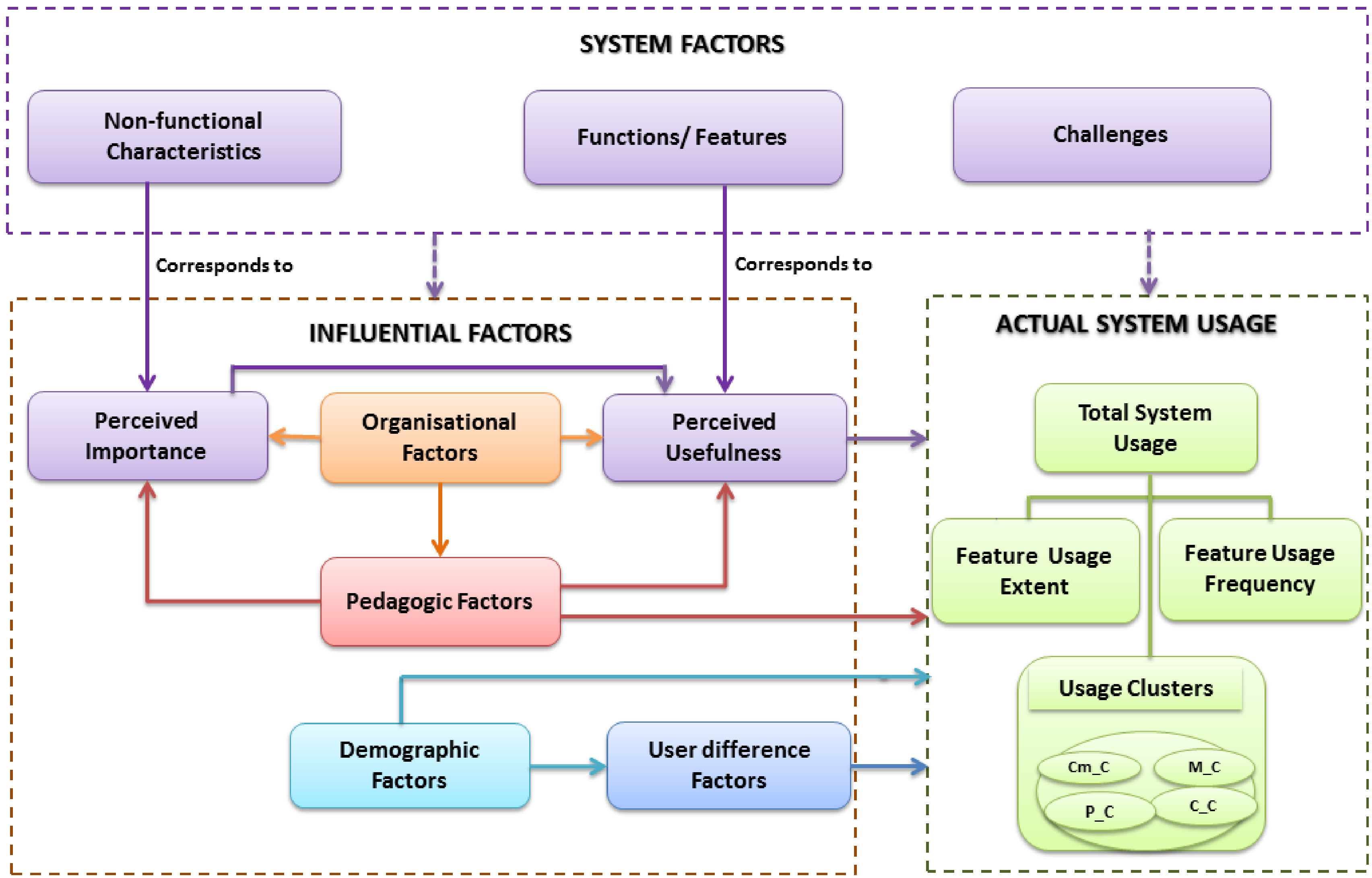

Figure 8.1: Virtual Learning System Model (VLSUM)

8.3.1 SYSTEM FACTORS component

The SYSTEM FACTORS component as depicted in Figure 8.1 consists of the following factors, namely, *Functions/Features*, *Non-functional characteristics* and *Challenges*, which are discussed in sub-sections 8.3.1.1, 8.3.1.2 and 8.3.1.3. The SYSTEM FACTORS_*Functions/Features and* SYSTEM FACTORS_*Non-functional characteristics* correspond to the *Perceived Usefulness* and *Perceived Importance* factors falling within the INFLUENTIAL FACTORS component of the model.

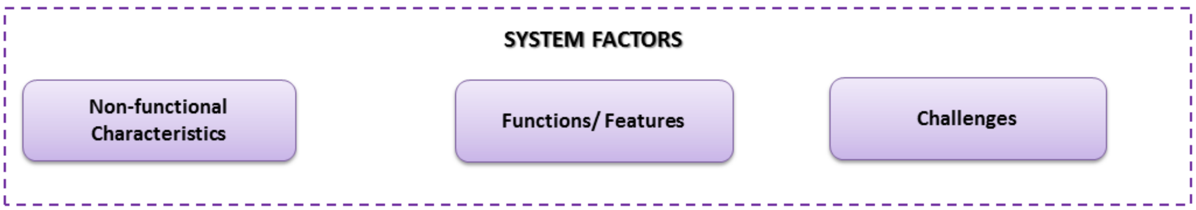

Figure 8.2: VLSUM SYSTEM FACTORS Component

8.3.1.1 Functions/Features

The SYSTEM FACTORS_*Functions/Features* include the following: assessment, content creation and dissemination, administration/management, communication, student productivity and involvement, and student tracking. The sub-functions comprising each of the SYSTEM FACTORS_ *Functions/Features* are as follows:

a) The assessment functions/features comprise the following sub-functions: online tests; online assignments; online marking and grading; and online grade book.
b) The content functions/features comprise the following sub-functions: content creation, content delivery and management.
c) The administration/ management functions/features comprise the following sub-functions: user management, course management and course design.
d) The communication functions/features comprise the following sub-functions: online threaded discussion forum; online real time chat; announcements/news forum; e-mail; blogging; wikis; videoconferencing; and shared whiteboard.
e) The student productivity and involvement functions/features comprise the following sub-functions: student productivity and student involvement.
f) Student tracking.

8.3.1.2 Non-functional Characteristics

The SYSTEM FACTORS_ Non-functional Characteristics include the following: flexibility; standards compliance (e.g., SCORM compliancy); security; reliability; usability (e.g., easy to learn and use; user friendliness) and performance/ efficiency.

8.3.1.3 Challenges

The SYSTEMS FACTORS_*Challenges* include the following:

- Compatibility issues with different operating systems.
- Missing functions/properties in course assessment (e.g. upload multiple images for an online quiz; an in-line commenting capability etc.).
- Missing functions/ properties in course content (e.g. import glossary function, metadata capability).
- Missing functions in course communication (e.g. integrated Web 2.0 functionality).
- Missing functions/ properties in course management (student view when designing activities).
- Inflexible design.
- Rigid architecture.

Table 8.1 presents the composition of the SYSTEM FACTORS component and supporting evidence for inclusion of the SYSTEM FACTORS in the study of virtual learning system usage.

Table 8.1: SYSTEM FACTORS component

System Factors	Composition	Support evidence for inclusion
1. ***Functions/ Features***	• Assessment • Content • Administration/management • Communication • Student productivity and involvement Student tracking.	• Perceived value of e-class features (Dutton et al., 2004). • Faculty ranking of VLS tool importance (Meerts, 2003). • LMS characteristics - the availability of appropriate functionalities (Nanayakkara, 2007). • Proposed model of IS usage (Bajaj & Nidumolu, 1998).
2. ***Non-functional Characteristics***	• Flexibility • Security • Reliability • Usability • Performance • Standards compliance.	The following non-functional system characteristics should be considered when adopting open-source software: 'maintenance, reliability, performance, scalability, usability, security, flexibility, customizability, and interoperability' (Wheeler, n.d.).
3. ***Challenges***	• Compatibility issues • Missing properties in assessment, content, communication and management functions/features	• Improve system functions (Egert et al., 2009). • Cannot adapt to varied knowledge, skills (Vovides et al., 2007).

System Factors	Composition	Support evidence for inclusion
	• No integrated Web 2.0 functionality • Inflexible design • Rigid architecture.	• "user-to-user messaging, notification" and awareness mechanisms, thread organization and management services need to be improved' (Egert et al., 2009: 457). • "Web 2.0 applications have the sophistication of graphic user interface designs that far out distance the seemingly archaic interfaces" of VLSs (McGee et al., 2005:154). • "Improve user interfaces "as well as "customization systems" in keeping with social media systems (Egert et al., 2009:457). • "A platform that relies on a classroom metaphor" is no longer appropriate for "breaking out of the classroom" (Beck, 2005:174). • "For the individual to find an application easy to use, there must be some consistency between the action language (e.g., what the user can do to the application) and the presentation language (e.g., how the application communicates to the user). Clearly, standardized user interfaces promote ease of use" (Hubona et al., 1996:173). • Supply-side institutions have to innovate, in their design of products (Attewell, 1992).

8.3.2 INFLUENTIAL FACTORS Component

An influential factor refers to factors having or exercising influence. The INFLUENTIAL FACTORS component, as depicted in Figure 8.1, consists of the following factors: *Perceived Usefulness*, *Perceived Importance*, *Pedagogic Factors*, *Organisational Factors*, *User Difference Factors* and *Demographic Factors,* which are discussed in sub-sections 8.3.2.1 to 8.3.2.6. The INFLUENTIAL FACTORS component represents having or exercising influence on the ACTUAL SYSTEM USAGE component.

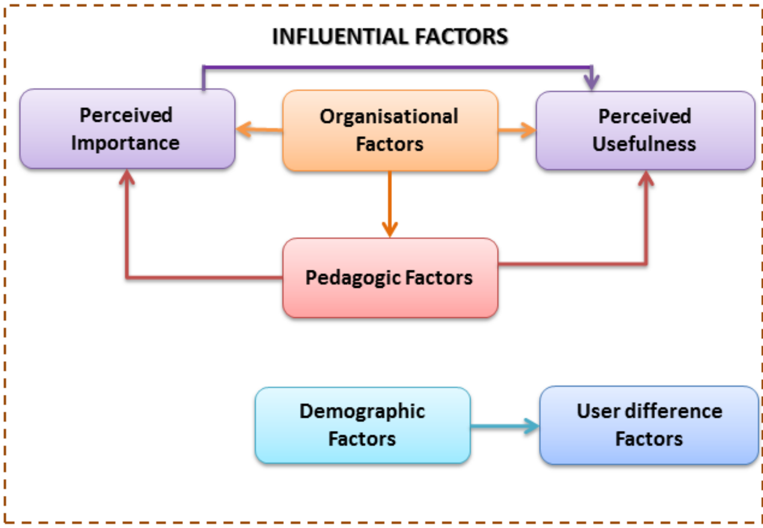

Figure 8.3: INFLUENTIAL FACTORS Component

8.3.2.1 Perceived Usefulness

Perceived usefulness is defined as 'the degree to which a person believes that using a particular system would enhance his or her job performance' (Davis, 1989). The INFLUENTIAL FACTORS_*Perceived Usefulness* corresponds to SYSTEM FACTORS_*Functions/Features*.

8.3.2.2 Perceived Importance

Perceived Importance refers to a person's beliefs on the importance/significance of system quality characteristics for using a system to integrate e-learning. The INFLUENTIAL FACTORS_ *Perceived Importance* (refers to a person's beliefs on the importance/significance of system quality characteristics for using a system to integrate e-learning) corresponds to SYSTEMS FACTORS_*Non-functional Characteristics*.

8.3.2.3 Pedagogic Factors

Pedagogic Factors refer to the role of factors corresponding to the science/profession of teaching, with regards to system usage to integrate e-learning. The INFLUENTIAL FACTORS_*Pedagogic Factors*, as depicted in Figure 8.1, include the following sub-factors:

- Pedagogic features, which comprise the following sub-features: support for teaching approaches underpinned by learning theories as well as instructional design activities.

- Characteristics of online teaching, which comprise the following sub-characteristics: flexible delivery; better course planning; more learner centred; more collaborative learning; better tracking of students' progress; more teaching or instructional strategies, and better course management.
- Challenges, which include distance mediation, discussion forum, prior learning and discipline specific issues.

8.3.2.4 Organisational Factors

Organisational Factors refer to factors within the organisation that support or impede system usage to integrate e-learning. The INFLUENTIAL FACTORS_*Organisational Factors*, as depicted in Figure 8.1, include the following sub-factors:

- E-learning support comprising instructional design and development support, user support, resources support, and policy/guidelines
- Challenges.

8.3.2.5 User Difference Factors

User Difference Factors refer to the role of differences in user characteristics on system usage to integrate e-learning. The INFLUENTIAL FACTORS_*User Difference Factors*, as depicted in Figure 8.1, includes the following sub-factors:

- Computer comfort level
- Teaching style preference
- Experience of online teaching (comfort, effectiveness, effort involved, and communication ease)
- Challenges.

8.3.2.6 Demographic factors

Demographic Factors refer to the role of user characteristics such as academic rank, level of study taught, system experience on system usage to integrate e-learning. The INFLUENTIAL FACTORS_ *Demographic Factors*, as depicted in Figure 8.1, include the following sub-factors:

- System experience
- Level of study (undergraduate/postgraduate).

Table 8.2 presents the INFLUENTIAL FACTORS component and supporting evidence for inclusion of INFLUENTIAL FACTORS in the study of virtual learning system usage.

Table 8.2: INFLUENTIAL FACTORS Component

INFLUENTIAL FACTORS	Composition	Support evidence for inclusion
1. *Perceived Usefulness*	Corresponds to SYSTEM FACTORS_*Functions/Features*: • Assessment • Content • Administration/management • Communication • Student productivity and involvement • Student tracking.	• Overview of the features of course management systems pertaining to teaching online courses (Barron, 2003). • Pedagogical uses of VLSs (Meerts, 2003). • The crux of perceived usefulness relates to the functionality of the application as enabling and expediting task-related job performance. Thus, to be perceived as useful, the functionality of the application must enable the user to accomplish job related tasks (Hubona et al., 1996). • There has to be fit between technology and task (Hubona et al., 1996) to be useful.
2. *Perceived Importance*	Corresponds to SYSTEMS FACTORS_ *Non-functional Characteristics*: • Flexibility • Security • Reliability • Usability • Performance • Standards compliance.	• The strongest influence on student use was system characteristics (McGill & Klobas, 2009). • LMS system characteristics (Nanayakkara, 2007). • According to McGill and Klobas (2009) ease of use leads to increased use.

3. *Pedagogic Factors*	• Pedagogic Features
	• Characteristics of Online Teaching
	  ○ Flexible delivery
	  ○ Better course planning
	  ○ More learner centred
	  ○ More collaborative learning
	  ○ Better tracking of students' progress
	  ○ More teaching or instructional strategies
	  ○ Better course management.
	• Challenges.
		Characteristics of online teaching
		• Increased communication, where students hold discussions and engage with course materials; include more interactive materials in their teaching (Morgan, 2003).
		• Greater flexibility to take a class at optimal times for the learner based on preferences or schedule constraints (Neal & Miller, 2005).
		Challenges
		• "It does not take into consideration that the educational material is presented to a large number of learners who have varied knowledge levels, skills, and learning strategies" (Vovides et al., 2007:67).
		• "Digital content housed never has a chance at reaching wider audiences through Web 2.0's network effects" because of the chasm between web 2.0 and VLSs (Alexander, 2008).
		• "The assessment activity should involve not only the use of objective online assessment but also other sets of assessment methods and formats, since this wider scope would enable students to demonstrate an ampler range of intellectual skills" (Chiheb et al., 2005:72).
		• Educators "teach the way they were taught using a traditional one-many teaching

INFLUENTIAL FACTORS	Composition	Support evidence for inclusion
		paradigm based on class lectures and discussion" (Dutton et al., 2004:77). • "Lecturers are setting up discussion threads with little understanding of how to engage students, how to structure their online interactions, or how to integrate these aspects of the course with other learning activities" with the result "their efforts have limited impact on students' learning experience" (Britain & Liber, 2004:5).
4. *Organisational Factors*	• e-learning support o Instructional design and development o User-support o Resources o Policy/guidelines. • Challenges.	• Organisational support ("training and support to design and deliver online content; ICT training and helpdesk support) and organisational characteristics (the need for faculty wide e-learning strategy, organisation culture towards e-learning, institutional leadership and institution wide strategy and funding priority for e-learning development; external system characteristics namely availability and capacity of ICT infrastructure, reliability of ICT infrastructure", online assessment facilitating conditions (Nanayakkara, 2007:7). • Facilitating conditions (Venkatesh et al., 2004). • Instructors have noted lack of technical support as one of the major factors inhibiting use (McGill & Klobas, 2009).
5. *User Difference Factors*	• Computer Comfort Level • Teaching Style Preference • Experience of Online Teaching o Comfort o Effectiveness o Effort o Communication ease. • Challenges.	• Effect of computer self- efficacy on instructors' acceptance of an e-learning system (Al-Busaidi & Al-Shihi, 2010). • Individual "skills and knowledge needed to develop and deliver online courses" (Nanayakkara, 2007:7). • Role of the instructor's teaching style (Al-Busaidi & Al-Shihi, 2010). • Comfort level with information technology in general (Machado & Tao, 2007). • Effective learning tools; communication tools enhanced interaction (Machado & Tao, 2007). • Effectiveness is one of the characteristics used to describe the construct 'quality in use' (ISO/IEC 9126-1), which refers to the user's view of the quality of software in use in an environment (Jung, 2007:654). • Instructor effort (Masrom et al., 2008). • Effective e-learning (Govindasamy, 2001). • Effectiveness of educational process. • Improved communication (Cavus &

INFLUENTIAL FACTORS	Composition	Support evidence for inclusion
		Momani, 2009). • The main inhibiting factors described in the literature were:' time needed to learn to use' a VLS; 'time requirements for online teaching', 'lack of technical support', issues around the 'quality of courses' and 'money to support development of courses' (McGill et al., 2008, p 649).
6. *Demographic Factors*	• System Experience • Level of Study.	• Experience with the use of technology (EUT) was found to play a major role with the acceptance of technology (Al-Busaidi & Al-Shihi, 2010). • Users' prior experience with learning management systems (Machado & Tao, 2007). • Introductory survey course (first level), skills development course (second level), theory and discussion course (senior and graduate level) (Cole & Foster, 2007).

8.3.3 ACTUAL SYSTEM USAGE component

According to Petter, DeLone and McLean (2008:239), system use refers to the "degree and manner in which staff and customers utilize the capabilities of an information system, for example the amount of use, frequency of use, nature of use, appropriateness of use, extent of use, and purpose of use".

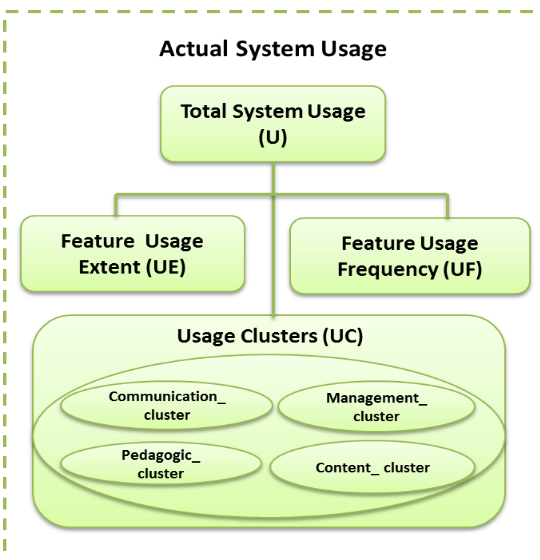

Figure 8.4: ACTUAL SYSTEM USAGE Expanded

The ACTUAL SYSTEM USAGE component, as depicted in Figures 8.1 and 8.2, is decomposed into 4 sub-components namely:

- *Total System Usage*
- *Feature Usage Extent*
- *Feature Usage Frequency*
- *Usage Clusters*.

Total System Usage considers ACTUAL SYSTEM USAGE from a system perspective (Chang, Lie & Fan, 2010) comprising all functions/features. The average frequency score of all functions/features surveyed in this research was used to measure *Total System Usage.*

Feature Usage Extent considers ACTUAL SYSTEM USAGE from a feature-centred perspective (refer to *SYSTEM FACTORS_ Functions/Features* in Figure 8.1 and accompanying description). The extent to which a system is used is defined as "breadth of use (number of features)" and as "variety of use (number of subtasks)" (Burton-Jones & Straub, 2006:233). The number of individual functions/features surveyed in this research was used to measure *Feature Usage Extent.*

Feature Usage Frequency: The measures for "frequency of use" is "number of times system" is used "(periods were: daily, weekly, etc.)" (Burton-Jones & Straub, 2006:230). In this study, Feature Usage Frequency refers to how often individual SYSTEM FACTORS_*Functions/ Features* were used measured on a five point scale from highest level of usage measured as 'usually' (5) to non- usage 'not at all' (1). The average frequency score was used to measure *Feature Usage Frequency (UF).*

Usage Clusters refer to groupings or patterns of ACTUAL SYSTEM USAGE (Chang et al., 2010; Dutton et al., 2004). The *usage clusters* identified, as depicted in Figure 8.1 and the expanded view in Figure 8.2, are as follows:

- Communication_cluster (Cm_C)
- Management_cluster (M_C)
- Pedagogic_cluster (P_C)
- Content_cluster (C_C).

The *Usage Clusters* are a subset of the SYSTEMS FACTORS_*Functions/Features*, as depicted in Figure 8.1.

The ACTUAL SYSTEM USAGE component is presented in Table 8.3 together with sub-components and supporting evidence for inclusion.

Table 8.3: ACTUAL SYSTEM USAGE component

Sub-Components	Composition	Supporting evidence for inclusion
1. *Total System Usage*	All Functions/Features	• According to Trice and Treacy (1988), the amount of usage an individual or group or organization makes of an information system is a key variable in MIS research. • Reconceptualising, which depicts system usage (Brannon & Essex, 2001; Kemp & Livingstone, 2006; Morgan, 2003; Martin, 2008; Vovides et al., 2007; Burton-Jones & Straub, 2006).
2. *Feature Usage Extent*	• Assessment • Content • Administration/management • Communication • Student productivity and involvement • Student tracking.	• Findings: few faculty members used VLS functions to assess students or to promote community. Most faculties used instructional functions, such as publishing syllabi, sending email, and providing readings. The communicative and interactive features were largely unused (Yueh & Hsu, 2008). • Extent of VLS use (Meerts, 2003).
3. *Feature Usage Frequency*	• Assessment • Content • Administration/management • Communication • Student productivity and involvement • Student tracking.	• Reconceptualising system usage (Burton-Jones & Straub, 2006). • Traffic analysis of VLS tool use by faculty and students (Meerts, 2003); (Petter et al., 2008).
4. *Usage Clusters (UC)*	• Communication cluster (Cm_C) • Management cluster (M_C) • Pedagogic cluster (P_C) • Content cluster (C_C).	• VLS usage patterns (Morgan, 2003; Beck, 2005; Oliver, 2001; Martin, 2008; Kemp & Livingstone, 2006). • Patterns of use (Dutton et al., 2004) Analysing VLS use patterns (Meerts, 2003).

This research used self-reported utilisation measures, namely, what functions were used and how often they were used. A summary of the core system functions/ features related to the four system *Usage Clusters* is displayed in Table 8.4 based on qualitative and quantitative data presented in Chapters 6 and 7, sections 6.4.2 and 7.3.4, respectively.

Table 8.4: System usage clusters

Usage Clusters	Functions/ Features
1. Communication_cluster	• Online threaded discussion forum • Online real time chat • Announcements/ bulletin board/ News forum • E-mail • Blogs • Shared whiteboard • Course calendar and schedule • File exchanges • Student online journal.
2. Management_ cluster	• Tracking student participation in online discussion forums • Grouping students • Selective release of documents • Setting up and organising courses • Online surveys • Online polls.
3. Content_cluster	• Presenting course information • Posting course content.
4. Pedagogic_cluster	• Wikis • Online glossary • Online quizzes/self-tests • Online test (i.e. credit bearing) • Online assignment submission • Online marking of assessments/ activities with grading and comments • Peer reviews of student posts • Grading of peer reviews • Peer evaluation of assignments • Grading student participation in online discussion forums/blogs • Creating lessons • Publishing marks in grade book.

8.3.4 Relationships between components of VLSUM

The relationships described in this section refer to the Virtual Learning System Usage Model depicted in Figure 8.1. The solid arrows on the conceptual model VLSUM represent correspondence relationships and correlation relationships. The correspondence relationships are labelled ‘Corresponds to’ and the unlabelled solid arrows in VLSUM are correlation relationships. Arrows with dashes between components refer to underlying relationships that have not been statistically tested. For example, the arrows with dashes between SYSTEM FACTORS and INFLUENTIAL FACTORS refer to the fact that SYSTEM FACTORS are the underlying component or the point of reference for the INFLUENTIAL FACTORS component. The arrows with dashes between the SYSTEM FACTORS component and ACTUAL SYSTEM USAGE component depict the relationships between the concept ‘usage’ and the ‘system’ referenced. The arrows with dashes between the SYSTEM FACTORS component and INFLUENTIAL FACTORS component depict the relationships between the factors that influence actual usage of the ‘system’ being referenced. The following sub-sections describe the relationships among model components.

8.3.4.1 Relationships between SYSTEMS FACTORS component and INFLUENTIAL FACTORS component

Confirmation survey findings indicated the following correspondence relationships between the SYSTEMS FACTORS and INFLUENTIAL FACTORS components as depicted in Figure 8.1:

- SYSTEMS FACTORS_*Functions/Features* and INFLUENTIAL FACTORS_*Perceived Usefulness*
- SYSTEMS FACTORS_*Non-functional Characteristics* and INFLUENTIAL FACTORS_ *Perceived Importance*.

8.3.4.2 Relationships between INFLUENTIAL FACTORS component and ACTUAL SYSTEM USAGE component

Confirmation survey findings indicated the following correlations between INFLUENTIAL FACTORS and ACTUAL SYSTEM USAGE components, as depicted in Figure 8.1:

- There is a positive correlation between *Perceived Usefulness* and ACTUAL SYSTEM USAGE meaning that high usage (*Total System Usage* and *Usage Clusters)* is correlated with strong agreement to statements of *Perceived Usefulness* corresponding to SYSTEM FACTORS_Functions/Features.
- There is a positive correlation between *Pedagogic Factors* and ACTUAL SYSTEM USAGE meaning that high usage (*Total System Usage* and *Usage Clusters)* is correlated with strong agreement to statements pertaining to *Pedagogic Factors:* Characteristics of Online Teaching.
- There is a positive correlation between *User Difference Factors* and ACTUAL SYSTEM USAGE meaning that high usage (*Total System Usage* and *Usage Clusters)* is correlated with strong agreement to statements pertaining to *User Difference Factors:* Experience of Online Teaching; and high usage (*Total System Usage)* is correlated with strong agreement to statements pertaining to self-reported measures of *User Difference Factors:* Computer Comfort and Experience and *User Difference Factors:* Teaching Style Preference.
- There is a positive correlation between *Demographic Factors* and ACTUAL SYSTEM USAGE meaning that high usage (*Total System Usage)* is correlated with strong agreement to self-reported measures pertaining to *Demographic Factors*, namely, System Experience and Level of Study.

8.3.4.3 Relationships within the INFLUENTIAL FACTORS component

Confirmation survey findings indicated the following correlations between INFLUENTIAL FACTORS as depicted in Figure 8.1:

- There is a positive correlation between *Perceived Usefulness* and *Perceived Importance* meaning that strong agreement to statements pertaining to *Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features* is correlated with strong agreement to statements pertaining to *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*.
- There is a positive correlation between *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEMS FACTORS_ *Functions/Features* meaning that strong agreement to statements pertaining to *Pedagogic Factors* is correlated with strong agreement to statements pertaining to *Perceived Usefulness* corresponding to SYSTEMS FACTORS_ *Functions/Features*.
- There is a positive correlation between *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* meaning that strong agreement to statements pertaining to *Pedagogic Factors* is correlated with strong agreement to statements pertaining to *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*.
- There is a positive correlation between *Organisational Factors* and *Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features* meaning that strong agreement to statements pertaining to *Organisational Factors* is correlated with strong agreement to statements pertaining to *Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features.*
- There is a positive correlation between *Organisational Factors* and *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* meaning that strong agreement to statements pertaining to *Organisational Factors* is correlated with strong agreement to statements pertaining to *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*.
- There is a positive correlation between *Organisational Factors* and *Pedagogic Factors* meaning that strong agreement to statements pertaining to *Organisational Factors* is correlated with strong agreement to statements pertaining to *Pedagogic Factors*.
- There is a positive correlation between *Demographic Factors* and *User Difference Factors (UDF)* meaning that strong agreement to statements pertaining to *Demographic Factors* is correlated with strong agreement to statements pertaining to *User Difference Factors*.

8.4 Method for using the VLSUM

The following sub-sections describe the methods that can be used by managers/directors of e-learning/educational technology departments, and instructional designers/educational technologists.

8.4.1 Method for using VLSUM model by managers/directors of e-learning or educational technology departments

The VLSUM consists of three (3) components, namely, SYSTEM FACTORS, INFLUENTIAL FACTORS and ACTUAL SYSTEM USAGE. The starting point for using the VLSUM is the INFLUENTIAL FACTORS component as it is the component that answers the question 'What are the factors that influence virtual learning system usage in higher education?'

The following 9 steps represent the process that managers/directors of e-learning or educational technology departments can follow to identify the composition of the three (3) components of VLSUM, namely, SYSTEM FACTORS, INFLUENTIAL FACTORS, and ACTUAL SYSTEM USAGE and the relationships between and within components with the intent to implementing interventions to optimize usage.

1. Review the INFLUENTIAL FACTORS component of the VLSUM.
2. Select the first INFLUENTIAL FACTORS_*Perceived Usefulness:*
    a. Consider the correspondence relationship between the INFLUENTIAL FACTORS_ *Perceived Usefulness* and SYSTEMS FACTORS_Functions/Features.
    b. Review the composition of the SYSTEMS FACTORS_Functions/Features comprising Assessment, Content creation and dissemination, Administration/ Management, Communication, Student productivity and involvement, and Student tracking that users (educators) deem to be useful for online teaching.
    c. Review the positive correlation relationship between INFLUENTIAL FACTORS_*Perceived Usefulness* and ACTUAL SYSTEM USAGE.
    d. Review the *Total System Usage*, *Feature Usage Extent*, *Feature Usage Frequency* and *Usage Clusters* representing ACTUAL SYSTEM USAGE.
    e. Compare *Functions/Features* deemed to be useful against the number of functions/ features used and associated usage frequencies.
    f. Develop and implement training programmes, and provide instructional design/development support to bridge the gap between what *Functions/ Features* are deemed useful and what *Functions/ Features* are used in the ACUTAL SYSTEM USAGE component.
3. Select the INFLUENTIAL FACTORS_*Perceived Importance:*

a. Review the correspondence relationship between INFLUENTIAL FACTORS_*Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics.*
b. Review the composition of the SYSTEMS FACTORS_Non-functional Characteristics deemed important by users (educators), which comprise the following: Flexibility, Security, Reliability, Usability, Performance and Standards compliance.
c. Review the positive correlation relationship between INFLUENTIAL FACTORS_*Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* and INFLUENTIAL FACTORS_*Perceived Usefulness* corresponding to SYSTEM FACTORS_ *Functions/Features.* The inference of this relationship is that users (educators) find *Functions/ Features* and *Non-functional Characteristics* to be equally important in a VLS.
d. Select a VLS that complies with the Non-functional Characteristics deemed important by users (educators) and ensure that the system installation/ implementation in an organisation guarantees characteristics such as security, reliability, and performance when using a VLS.

4. Select the INFLUENTIAL FACTORS_*Organisational Factors:*
   a. Identify the composition of the *Organisational Factors,* which comprise e-learning support and Challenges.
   b. Identify the composition of e-learning support, namely, instructional design and development support, user support, resources support, and policy/guidelines.
   c. Identify the composition of Challenges, namely, technology infrastructure, training issues and general organisational challenges.
   d. Review the positive correlation between *Organisational Factors and Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features*. This shows a relationship between the *Functions/Features* deemed useful and need for organisational e-learning support.
   e. Review the positive correlation between *Organisational Factors and Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*. This shows a relationship between the importance of *Non-functional Characteristics* and need for organisational e-learning support.
   f. Review the positive correlation between *Organisational Factors and Pedagogic Factors.* The correlational analysis shows a relationship between *Organisational Factors*: e-learning support and three *Pedagogic Factors*, namely, Pedagogic Features, Characteristics of Online Teaching, and Challenges. This means that users (educators) find e-learning support as being interrelated to Pedagogic Factors. In addition, the correlational analysis shows a relationship between *Organisational Factors*: Challenges and two *Pedagogic Factors*, namely, Pedagogic Features and Challenges. This means that users (educators) find that there is a co-presence of

organisational challenges and pedagogic challenges, which are also related to the need for pedagogic features.

g. Review the indirect relationship between *Organisational Factors* and ACTUAL SYSTEM USAGE. This relationship can be used to understand inadequate support and inhibiting factors. An understanding of organisational support, e.g., resources and user support needed and organisational challenges can form the basis for necessary improvements and/ or interventions by management to improve ACTUAL SYSTEM USAGE.

5. Select the INFLUENTIAL FACTORS_*Pedagogic Factors:*
   a. Review the composition of *Pedagogic Factors,* namely, sub-factors Pedagogic features, Characteristics of online teaching, and Challenges.
   b. Review the composition of sub-factor Pedagogic Features namely the various teaching approaches and instructional design activities used by educators
   c. Review the composition of sub-factor Characteristics of online teaching, namely, flexible delivery; better course planning; more learner centred; more collaborative learning; better tracking of students' progress; more teaching or instructional strategies, and better course management.
   d. Review the composition of sub-factor Challenges of online teaching, which include distance mediation, discussion forum, prior learning and discipline specific issues.
   e. Review the positive correlation between *Pedagogic Factors* and ACTUAL SYSTEM USAGE. This relationship shows that *Pedagogic Factors* directly influence ACTUAL SYSTEM USAGE.
   f. Review the positive correlation between *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features.* This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*.
   g. Review the positive correlation between *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_*Non-functional characteristics.* This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_*Non-functional Characteristics.*
   h. Use the information on *Pedagogic Factors* as the basis for the implementation of professional teaching with technology training programmes to improve ACTUAL SYSTEM USAGE.
6. Select the INFLUENTIAL FACTORS_*Demographic Factor*:
   a. Review the composition of *Demographic Factors*, namely, System experience and Level of Study
   b. Review the composition of sub-factor System experience, namely, length of usage and number of online/hybrid courses taught.

c. Review the positive correlation between *Demographic factors* that influence ACTUAL SYSTEM USAGE. This relationship shows that *Demographic Factors* directly influence ACTUAL SYSTEM USAGE.

d. Use the information on *Demographic factors* such as system experience and level of study (undergraduate/postgraduate) to identify and justify the need for *customised* instructional design/ development support based on level of study and system experience.

e. Review the correlation between *Demographic factors:* System experience and *User Difference Factors:* Experience of online teaching. This relationship shows that as educators get more system experience they display a higher positive experience of online teaching. Use this information to understand that ACTUAL SYSTEM USAGE improves as educators gain more experience of the system.

7. Select INFLUENTIAL FACTORS_*User Difference Factors*:

a. Review the composition of *User Difference Factors*, namely, Computer comfort level, Teaching style preference, and Experience of online teaching.

b. Review the composition of sub-factor Experience of online teaching, namely, comfort, effectiveness, effort involved, and communication ease.

c. Review the composition of sub-factor Challenges, namely, lack of time, changing mind-set to online teaching and lack of confidence.

d. Review the correlation between *User Difference Factors* and ACTUAL SYSTEM USAGE. This relationship shows that *User Difference Factors* directly influences ACTUAL SYSTEM USAGE.

e. Use this information on *User Difference Factors* to understand inhibiting *factors,* which can be used to design and implement *group training programmes* and/or provide *individualised instructional design/ development support* to improve ACTUAL SYSTEM USAGE.

8. Select the ACTUAL SYSTEM USAGE component:

a. Review the sub-components of ACTUAL SYSTEM USAGE, namely, *Total System Usage Feature Usage Extent*, *Feature Usage Frequency*, and *Usage Clusters*.

b. Use this information to understand the *Total System Usage* using an average frequency score of all functions/features; *Feature Usage Extent* by the breadth of functions/ features used; *Feature Usage Frequency* by the average frequency score of individual functions/ features used; and *Usage Clusters* by the average frequency score of groupings of functions/features used.

9. Re-assess ACTUAL SYSTEM USAGE once training and instructional design/ development interventions identified in Steps 2-7 have been implemented in the form of a follow-up usage survey.

8.4.2 Method for using VLSUM by other stakeholders, namely, instructional designers/ educational technologists

The starting point for using the VLSUM for instructional designers/ educational technologists is INFLUENTIAL FACTORS_*Pedagogic Factors* as they are linked to the SYSTEM FACTORS and ACTUAL SYSTEM USAGE components of VLSUM.

The following step and accompanying sub-steps represent the process that instructional designers / educational technologists can follow to identify the composition of the INFLUENTIAL FACTORS_*Pedagogic Factors;* and the relationships between the INFLUENTIAL FACTORS component and between INFLUENTIAL FACTORS_*Pedagogic Factors* and the ACTUAL SYSTEM USAGE component. The goal would be to use this information/knowledge to designing standardised and customised training interventions to optimize ACTUAL SYSTEM USAGE.

1. Select the INFLUENTIAL FACTORS_*Pedagogic Factors:*
    a. Review the composition of *Pedagogic Factors*, namely, sub-factors Pedagogic features, Characteristics of online teaching, and Challenges.
    b. Review the composition of the sub-factor Pedagogic Features, namely, the various teaching approaches and instructional design activities used by educators.
    c. Review the composition of sub-factor Characteristics of online teaching, namely, flexible delivery; better course planning; more learner centred; more collaborative learning; better tracking of students' progress; more teaching or instructional strategies, and better course management.
    d. Review the composition of the sub-factor Challenges of online teaching, which include distance mediation, discussion forum, prior learning and discipline specific issues.
    e. Review the positive correlation between *Pedagogic factors* and ACTUAL SYSTEM USAGE. This relationship shows that *Pedagogic Factors directly* influence ACTUAL SYSTEM USAGE.
    f. Review the positive correlation between *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*. This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*.
    g. Review the positive correlation between *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_*Non-functional Characteristics.* This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_ *Non-functional Characteristics.*

h. Use the information on *Pedagogic Factors* as the basis for the design of technology training programmes/ workshops and support educators to design their online courses in keeping with preferred teaching methods and instructional design activities in order to actuate the characteristics of online teaching. The ultimate goal is to improve ACTUAL SYSTEM USAGE by educators in higher education.

8.5 Summary

This chapter presented the qualitative and quantitative empirical findings with supporting evidence from the literature in order to answer the main research question and research sub-questions presented in Chapters 1 and 5. From the combined qualitative and quantitative findings of the study, one can draw the following conclusions:

- SYSTEM FACTORS and *concomitant* factors of *Perceived Usefulness* and *Perceived Importance* directly influenced ACTUAL SYSTEM USAGE.
- *Pedagogic Factors* directly influenced ACTUAL SYSTEM USAGE.
- *User Difference Factors* directly influenced ACTUAL SYSTEM USAGE.
- *Demographic Factors* directly influenced ACTUAL SYSTEM USAGE.

The following positive correlations were identified between different factor components:

- *User Difference Factors:* Experience of online teaching and *Demographic Factors*: System experience.
- *Organisational Factors* and SYSTEM FACTORS corresponding to *Perceived Usefulness* and *Perceived Importance*; and between *Organisational Factors* and *Pedagogic Factors*. *Organisational Factors* can, therefore, be assumed to have indirectly influenced ACTUAL SYSTEM USAGE.
- SYSTEM FACTORS and *Pedagogic Factors*.

The proposed conceptual model was presented together with a discussion of the components, relationships between factors of the different components, supportive literature evidence for the components, and method for using the model. In addition, the model was compared to other acceptance and system usage models and the application of the model was covered. The confirmation of the model is discussed in Chapter 9.

CHAPTER 9: MODEL CONFIRMATION

9.1 Introduction

The VLSUM was developed on the knowledge obtained from an extended literature survey as well as qualitative and quantitative findings. Secondary data obtained from literature study and written sources in the form of software specification documents was triangulated with primary data obtained from semi-structured focused interviews and structured surveys (questionnaires). The aim of this chapter is to discuss the evaluation of the model proposed in Chapter 8 and to discuss the findings of the evaluation.

The VLSUM was evaluated via an empirical method using interviews. Confirmation involved approving the model components and relationships for relevance/applicability and completeness. Section 9.2 of the chapter describes the model confirmation approach adopted, followed by section 9.3, which presents the results of the confirmation process. Section 9.4 presents a summary of the chapter.

9.2 Model confirmation approach

This section discusses the approach followed to confirm the relevance/ applicability and usefulness of the Virtual Learning System Usage Model (VLSUM). The steps followed for this phase were as follows:

9.2.1 Design of the model verification instrument

A model verification instrument interview schedule (refer to Appendix 3) was designed in order to conduct the model confirmation process. The structure of the model confirmation interview schedule, and the objectives to be achieved was presented in Chapter 5, section 5.7.6 and is repeated in Table 9.1.

Table 9.1: Model confirmation design

Question category	**Objective**
VLSUM Components	Establish the relevance of INFLUENTIAL FACTORS component and relationships to other VLSUM components.
Method for using the VLSUM	Establish whether the method for using VLSUM by managers/directors of e-learning or educational technology departments is practical for implementation and would promote improved VLS feature usage in higher education.
INFLUENTIAL FACTORS_*Perceived usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*	Establish whether INFLUENTIAL FACTORS_*Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features* is an adequate representation.
INFLUENTIAL FACTORS_Perceived importance corresponding to SYSTEM FACTORS_*Non-Functional Characteristics*	Establish whether the INFLUENTIAL FACTORS_*Perceived importance* corresponding to SYSTEMS FACTORS_Non-Functional Characteristics is an adequate representation.
INFLUENTIAL FACTORS_*Pedagogic Factors*	Establish whether the INFLUENTIAL FACTORS_*Pedagogic Factors* is an adequate representation.
INFLUENTIAL FACTORS_*Organisational Factors*	Establish whether the INFLUENTIAL FACTORS_ *Organisational Factors* is an adequate representation.
INFLUENTIAL FACTORS_*User Difference Factors*	Establish whether the INFLUENTIAL FACTORS_*User Difference Factors* is an adequate representation.
INFLUENTIAL FACTORS_*Demographic Factors*	Establish whether the INFLUENTIAL FACTORS_ *Demographic Factors* is an adequate representation.
ACTUAL SYSTEM USAGE component	Establish whether the ACTUAL SYSTEM USAGE component is an adequate representation.
INFLUENTIAL FACTORS_*Pedagogic Factors*	Establish usefulness of information/ knowledge on Pedagogic Factors to managers/directors of e-learning or educational technology departments as well as educational technologists/instructional designers for improving ACTUAL SYSTEM USAGE in higher education.
INFLUENTIAL FACTORS_*Organisational Factors*	Establish usefulness of information/ knowledge on Organisational Factors to managers/directors of e-learning or educational technology departments for improving ACTUAL SYSTEM USAGE in higher education.
INFLUENTIAL FACTORS_*User Difference Factors*	Establish usefulness of information/ knowledge on User Difference Factors to managers/directors of e-learning or educational technology departments for improving ACTUAL SYSTEM USAGE in higher education.
INFLUENTIAL FACTORS_*Demographic Factors*	Establish usefulness of information/ knowledge on Demographic Factors to managers/directors of e-learning or educational technology departments for improving ACTUAL SYSTEM USAGE in higher education.
INFLUENTIAL FACTORS_*User Difference Factors*_ Challenges	Establish whether information/knowledge on the following INFLUENTIAL FACTORS_*User Difference Factors*_ Challenges is useful for identifying and addressing inhibiting factors to Actual System Usage.
INFLUENTIAL FACTORS_*Organisational Factors*_ Challenges	Establish whether information/knowledge on the following INFLUENTIAL FACTORS_*Organisational Factors*_ Challenges is useful for identifying and addressing inhibiting factors to ACTUAL SYSTEM USAGE.

9.2.2 Conducting interviews to confirm/verify model

The VLSUM was evaluated using interviews. The model was evaluated using representatives of the main stakeholder groups, namely, one manger of an e-learning department and one project leader of e-learning, as well as one educational technologist/instructional designer that would benefit from VLSUM. Four managers/directors/ project leaders of e-learning/educational technology departments and one educational technologist were approached to conduct an interview to verify the model. Three positive responses were received, one from a manager of the academic computing department, another from a project leader of e-learning and a third from an educational technologist. The gender composition of the interview participants were two females and one male. All three participants were employed in higher education institutions. The confirmation process followed was to provide participants with a document that depicted the model followed by a short description of model components and relationships, and the model confirmation interview schedule prior to the interview. During the interview, the model relationships were further unpacked by using examples (refer to Appendix 6) to facilitate understanding of abstract relationships in the model. All of these techniques were used to help participants understand the model before confirmation took place. The duration of the interviews with the manager and project leader of e-learning was ninety minutes while the duration of the interview with the educational technologist was thirty minutes as this interview only focussed on the pedagogic component of VLSUM and its relationships, which was the speciality of the educational technologist. Responses to questions and additional comments made were recorded.

Table 1 from the model verification instrument (refer to Appendix 3) is included in this chapter as Table 9.2 to facilitate understanding of the components verified.

Table 9.2: Adapted evaluation questions pertaining to INFLUENTIAL FACTORS component of VLSUM

VLSUM Components	Evaluation Questions
INFLUENTIAL FACTORS • Organisational • Perceived usefulness • Perceived Importance • Pedagogic • User difference • Demographic.	What is your perception on the relevance of the following INFLUENTIAL FACTORS of VLSUM to the use of VLSs, which conceptualizes : • *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features* • *Perceived Importance corresponding to* SYSTEM FACTORS_*Non-functional characteristics* • *Pedagogic* • *Organisational* • *User difference* • *Demographic Factors*?
Organisational Factors* → *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features	What is your perception on the relevance of the relationship in VLSUM between *Organisational Factors* (e.g., institutional e-learning capability support in respect of infrastructure, bandwidth, computer availability, instructional design and development support) AND *Perceived usefulness* related to SYSTEMS FACTORS_*Functions/ Features* (e.g., course assessment, course communication)?
Organisational Factors* → *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics	What is your perception on the relevance of the relationship in VLSUM between *Organisational Factors* (e.g. institutional e-learning capability resource support, user support, etc.) AND *Perceived Importance* corresponding to SYSTEMS FACTORS_ *Non-functional Characteristics* (e.g., reliability, usability, performance)?
Organisational Factors* → *Pedagogic Factors	What is your perception on the relevance of the relationship in VLSUM between *Organisational factors* (institutional e-learning capability support, e.g., instructional design and development support, user support etc.) AND *Pedagogic Factors* (Pedagogic features e.g. teaching approaches, instructional design etc.)?
Pedagogic Factors* → *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features	What is your perception on the relevance of the relationship in VLSUM between *Pedagogic Factors* (teaching approaches, instructional design, characteristics of online teaching) AND *Perceived usefulness* corresponding to *Systems factors: VLS Functions/ Features* (e.g., course assessment, course communication)?
Pedagogic Factors* → *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics	What is your perception on the relevance of the relationship in VLSUM between *Pedagogic Factors* (teaching approaches, instructional design, characteristics of online teaching) AND *Perceived Importance* related to *Systems factors: VLS Non-functional characteristics* (e.g., reliability, usability, performance)?

VLSUM Components	Evaluation Questions
Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* → *Perceived usefulness* corresponding to SYSTEM FACTORS_*Functions/Features	What is your perception on the relevance of the relationship in VLSUM between *Perceived usefulness* related to *Systems factors: Functions/ Features* (e.g. course assessment, course communication) AND *Perceived Importance* related to *Systems factors: VLS Non-functional characteristics* (e.g., performance, security etc.)?
Demographic Factors → User Difference Factors	What is your perception on the relevance of the relationship in VLSUM between *Demographic Factors* (e.g., system experience) AND *User Difference Factors* (e.g., Experience of online teaching of online teaching)?
***Perceived usefulness* corresponding to SYSTEM FACTORS_*Functions/Features* → ACTUAL SYSTEM USAGE**	What is your perception on the relevance of the relationship in VLSUM between *Perceived usefulness* corresponding to Systems factors: Functions/ Features AND ACTUAL SYSTEM USAGE?
***Pedagogic Factors* → ACTUAL SYSTEM USAGE**	What is your perception on the relevance of the relationship in VLSUM between *Pedagogic Factors* (Characteristics of online teaching) AND ACTUAL SYSTEM USAGE?
***User Difference Factors* → ACTUAL SYSTEM USAGE**	What is your perception on the relevance of the relationship in VLSUM between *User Difference Factors* (e.g., user computer comfort level; teaching style preference and experiences of online teaching) AND ACTUAL SYSTEM USAGE?
***Demographic Factors* → ACTUAL SYSTEM USAGE**	What is your perception on the relevance of the relationship in VLSUM between *Demographic Factors* (e.g., system experience and level of study AND ACTUAL SYSTEM USAGE?

9.3 Results of the confirmation

The following sub-sections summarise the findings of the model confirmation.

9.3.1 Confirmation on the relevance of INFLUENTIAL FACTORS component and relationships to other VLSUM components

The two participants representing the stakeholder category of managers/directors/project leaders of e-learning/educational technology departments confirmed the INFLUENTIAL FACTORS of VLSUM, which conceptualized INFLUENTIAL FACTORS_*Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*, INFLUENTIAL FACTORS_*Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*, INFLUENTIAL FACTORS_*Pedagogic*, INFLUENTIAL FACTORS_*User difference* and INFLUENTIAL FACTORS_*Demographic Factors* (refer to Table 1 in Appendix 3) to be relevant to the use of VLSs.

The participant representing the stakeholder category educational technologists/instructional designers verified the *Pedagogic Factors* as an INFLUENTIAL FACTOR of VLSUM relevant to the use of VLSs.

The representatives of the two stakeholder groups verified the relationships between the INFLUENTIAL FACTORS component, the SYSTEM FACTORS component and the ACTUAL SYSTEM USAGE component and inter-relationships among the INFLUENTIAL FACTORS component (Refer to Table 1: Appendix 3) and repeated in Table 9.2.

One of the participants added that actual usage of features was also determined by need when discussing the relationship between INFLUENTIAL FACTORS_*Demographic factors*, namely, System experience and ACTUAL SYSTEM USAGE.

9.3.2 Confirmation on the practicality of method for using VLSUM

In response to the practicality of the method for using VLSUM for implementation, the following comments were made:

- Agreed with the method at a generic level.
- Added that improvements/interventions are subject to budgetary constraints in response to Step 4 of method, where it was suggested that resources and user support needed and organisational challenges should be used as the basis for necessary improvements and/ or interventions by management to improve ACTUAL SYSTEM USAGE.
- Added that community of practice (COP) support could be used as an extension of training programme intervention in response to Step 2, where it was suggested that training programmes be implemented, and provision should be made for instructional design/development support.
- Added that the need for a coherent support structure was being implemented because of the gap identified in Step 6, where mention was made of the role of *Demographic Factors* such as system experience and levels of study on ACTUAL SYSTEM USAGE.
- Added that some educators view technology as an intrusion, others are techno-phobic and yet other are ideologically resistant to the use of technology in response to Step 7, where mention was made of the role of *User Difference Factors* on ACTUAL SYSTEM USAGE.
- Added that there was a need for a stratified system of training support that was not necessarily discipline related but rather organised with bigger cohorts for basic training, small group workshops and individualised instructional design support. Also commented that training can take

various forms such as online as well as face-to-face support in response to Step 7, where the suggestion was made to provide group training programmes as well as individualised instructional design/ development support.

- A final general comment made was that at the strategic level the institution's goal was to coordinate and synchronise the level of adoption and usage of virtual learning systems in higher education.

9.3.3 Confirmation of each of the INFLUENTIAL FACTORS of VLSUM and the ACTUAL SYSTEM USAGE component

The participants representing the two stakeholder groups confirmed the adequacy of the composition for each of the INFLUENTIAL FACTORS of VLSUM, namely, *Perceived Usefulness* related to SYSTEMS FACTORS*_Functions/Features; Perceived Importance* related to the *SYSTEMS FACTORS_Non-functional characteristics; Pedagogic factors; Organisational Factors; Demographic Factors and User Difference Factors* as well as the sub-components of ACTUAL SYSTEM USAGE (Refer to Tables 2 to 8 in Appendix 3) described in Chapter 8, section 8.3.

9.3.4 Confirmation on the usefulness of information/ knowledge on *Organisational, Pedagogic*, *User Difference* and *Demographic Factors*

The participants representing the two stakeholder groups agreed that information/knowledge on the above-mentioned INFLUENTIAL FACTORS (refer to Tables 9 to 13 of Appendix 3) could be used to identify enabling or inhibiting factors with a view to initiating improvements or training interventions and instructional design/development support for improving ACTUAL SYSTEM USAGE. These factors were identified and described in Chapters 6, 7, and 8.

Some of the comments made with regards to INFLUENTIAL FACTORS, namely, *Organisational Factors*, *User Difference Factors* and *Demographic Factors* were as follows:

- Commitment from top management is critical.
- The low bandwidth was recognised as an issue and the institution has improved its bandwidth capacity and is embarking on wireless rollout.
- Teaching style preference is a luxury given the student mass drive initiative for higher education in accordance with the National Policy for higher education.
- The lack of seamless integration between university systems was recognised as an issue and remedied with the single logon system.

- The job of top management is to put strategies in place to improve usage of virtual learning systems.
- The access problem was going to be addressed in the near future with the rollout of tablets to students.

Some of the comments made with regards to INFLUENTIAL FACTORS_*Pedagogic Factors* were as follows:

- A teaching with assessment approach where students are given individual responses (feedback) to quizzes based on the options chosen should also be considered.
- Assessment is an important aspect of teaching and includes both formative and summative forms.
- Educators use a whole range of learning theories from behaviourism to constructivist.
- Although covered implicitly, explicit mention should be made of social networking for education and mobile learning.
- The characteristics of online teaching is useful as each of these characteristics translate to a list of topics that can be unpacked in face-to-face or online workshops and can be made available as resource material.

9.4 Summary

The process followed for confirmation of the components of VLSUM representing the factors that influence virtual learning system usage in higher education was discussed in section 9.2. The results of the model confirmation were discussed in section 9.3. The next chapter discusses the scientific and product contribution of the study.

CHAPTER 10: CONTRIBUTION OF STUDY

10.1 Introduction

The main focus of this chapter is to discuss the scientific and product contribution made by this study. The scientific contribution is the proposed conceptual model representing factors that influence virtual learning system usage in higher education. This chapter discusses the contribution made by this study on the body of literature pertaining to the design of virtual learning systems (VLSs) in respect of SYSTEM FACTORS_*Functions/Features* and SYSTEM FACTORS_*Non-functional Characteristics*. In addition, this study made a contribution in respect of INFLUENTIAL FACTORS to ACTUAL SYSTEM USAGE in higher education, namely, *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/ Features; Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional characteristics*; *Pedagogic Factors*; *Organisational Factors*; *User Difference Factors* and *Demographic Factors*. Finally, this study made a contribution to the ACTUAL SYSTEM USAGE in respect of *Feature Usage Extent*; *Feature Usage Frequency*, *Total System Usage*, and *Usage Clusters*. Section 10.2 discusses the scientific contribution followed by Section 10.3, which covers the product contribution of the study. Section 10.4 provides a summary of the chapter.

10.2 Scientific contribution

The main contribution of this study is a Virtual Learning System Usage Model (VLSUM) shown in the figure 10.1 depicting the INFLUENTIAL FACTORS, namely SYSTEM FACTORS corresponding to *Perceived Usefulness* and *Perceived Importance*, *Pedagogic Factors*, *Organisational Factors*, *User Difference Factors* and *Demographic factors* on virtual learning system usage in higher education.

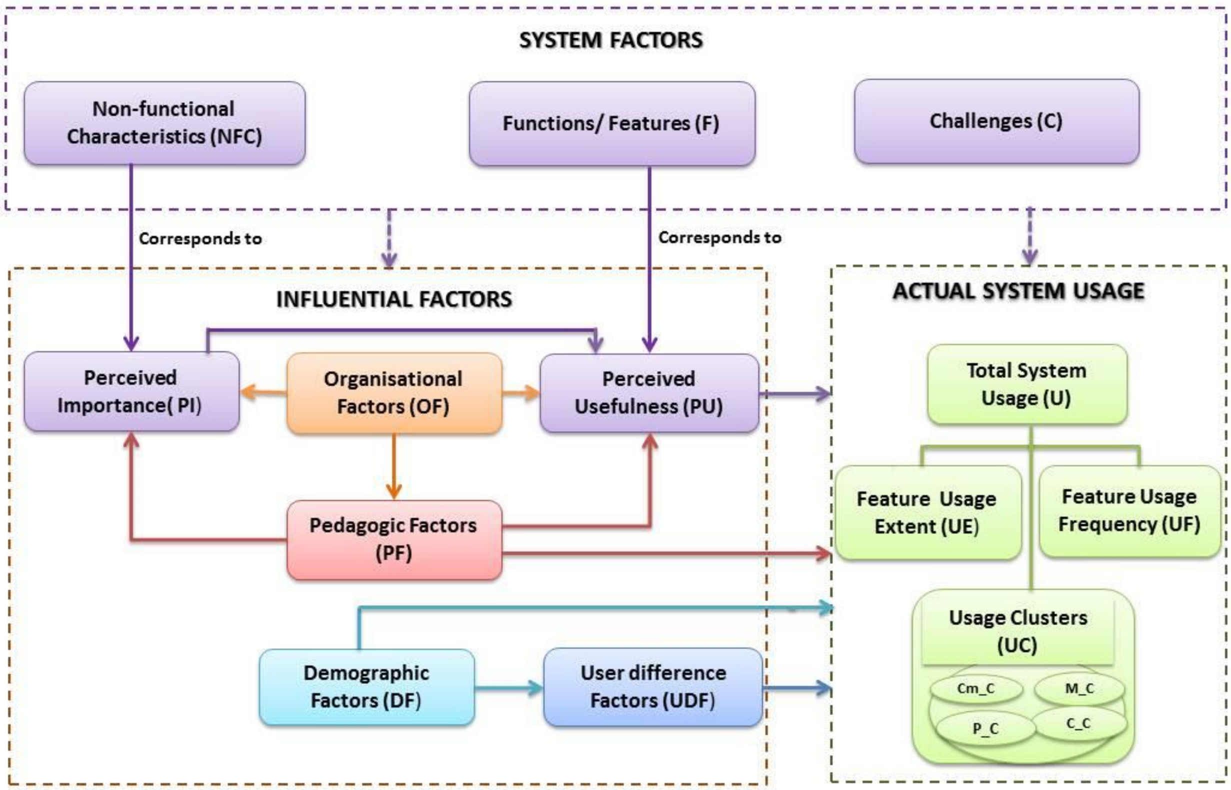

Figure 10.1: Virtual learning System Usage Model (VLSUM)

Virtual learning systems (VLSs) have been part of the higher education landscape for over a decade, but acceptance and usage of these systems have been largely uneven. Moreover, these systems have not transformed educational practices as envisaged. By and large, these systems have been developed with limited faculty input and little, if any, attempts have been made to actively involve users in the design of the system. VLSUM could be useful or valuable to educational technologists/instructional designers, system designers, managers of educational technology units and researchers.

The application of VLSUM is presented in 10.2.1 followed by a comparison of VLSUM to other models related to ACTUAL SYSTEM USAGE in 10.2.2. The usefulness of VLSUM to managers/directors of e-learning or educational technology departments, system designers, instructional designers/ educational technologists, and researchers is discussed in section 10.2.3. The scientific contribution of this study also involved testing assumptions of underlying theories, replicating theories, extending existing models and synthesising theories from different fields, which are discussed in section 10.2.4. The product contribution is presented in section 10.3, followed by a summary of the chapter in section 10.4.

10.2.1 Application of VLSUM

The proposed VLSUM model is applicable to studies investigating factors influencing ACTUAL SYSTEM USAGE, where ACTUAL SYSTEM USAGE is conceptualised from the perspective of IS acceptance and usage and where ACTUAL SYSTEM USAGE is the dependent variable. The factors are general and are applicable to utilisation studies involving any educational technology system. Furthermore, functions/features pertaining to three of the usage clusters, namely, the *Communication, Management and Content* are generic in nature and can, therefore, apply to other information systems. The fourth usage cluster, namely, the *Pedagogic Cluster* is specific to the domain of online teaching and learning and, more specifically, to pedagogic features of VLSs. In this study, the task domain features pertain to the domain of education and the tasks revolve around teaching and learning activities. This component can be replaced by the appropriate domain specific tasks when applied to utilisation studies involving other information systems.

10.2.2 Comparison of VLSUM with other models related to ACTUAL SYSTEM USAGE

10.2.2.1 VLSUM and TAM

The main determinants of Perceived Usefulness (PU) and perceived ease of use (PEOU) in TAM as well as the external variables that influence PU and PEOU, namely system characteristics, training, and user support consultants have been modelled as the *Perceived usefulness* corresponding to SYSTEM FACTORS_*Functions/ Features*; *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*; and *Organisational Factors* (e-learning support) in VLSUM.

10.2.2.2 VLSUM and TRA (Theory of Reasoned Action)

The ‘other factors’ category in TRA that indirectly influence usage behaviour are system design, user characteristics, task characteristics, and the nature of the implementation process. From the perspective of the theory of reasoned action, information technology can be characterised as a system which provides potentially useful functions (Trice & Treacy, 1988). The ‘other factors’ category in TRA have been modelled as the *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/ Features* and *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional characteristics*; tasks characteristics have been modelled as *Pedagogic Factors*; user characteristics have been modelled as *User Difference Factors* and the implementation process has been modelled as *Organisational Factors*.

10.2.2.3 VLSUM and UTAUT (Unified Theory of Acceptance and Use of Technology)

“Performance expectancy (the degree to which an individual believes that using the system will help him or her to attain gains in job performance), effort expectancy (degree of ease associated with the use of the system) facilitating conditions (defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system)" in UTAUT and the role of experience with the system (Venkatesh et al., 2004:447-453) represent variables that are similar to the factors investigated in this study. Performance expectancy and effort expectancy have been modelled as *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features* and *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*; job performance *has been modelled as Pedagogic Factors*; facilitating conditions have been modelled as *Organisational Factors*; and the role of experience with the system has been modelled as *Demographic Factors* in VLSUM.

10.2.2.4 VLSUM and utilisation models

Trice and Treacy (1988:13) presented a research framework comprising "design and implementation process variables, information system characteristics, individual differences and task characteristics" for technology utilisation. Nanayakkara (2007) proposed a model of factors relating to e-learning adoption that was centred on three key factors: individual, system and organisational. VLSUM is consistent with the Nanayakkara (2007) framework and model as it examined the influence of SYSTEM FACTORS (information system design functions/features and information system characteristics), *Pedagogic Factors* (task characteristics), *Organisational Factors* (organisational); as well as *User Difference Factors* (individual characteristics). VLSUM added another dimension, namely, *Demographic Factors* to study ACTUAL SYSTEM USAGE.

10.2.3 Usefulness of VLSUM

10.2.3.1 Managers/directors of e-learning or educational technology departments

VLSUM provides knowledge on the following factors that are of value to managers/directors of e-learning or educational technology departments:

- *Perceived Usefulness* corresponding to SYSTEM FACTORS_ Functions/Features that directly influenced ACTUAL SYSTEM USAGE. This knowledge can be used by managers/directors of e-learning or educational technology departments to bridge the gap between SYSTEM FACTORS_ Functions/Features deemed useful and ACTUAL SYSTEM USAGE via interventions such as training programmes and instructional design/development support.
- *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* that bore a direct influence on *Perceived Usefulness* corresponding to SYSTEM FACTORS_ *Functions/Features* and an indirect influence on ACTUAL SYSTEM USAGE. Managers/directors of e-learning or educational technology departments can use the knowledge of SYSTEM FACTORS_*Non-functional Characteristics* deemed important to ensure that that the

implementation of a VLS in an organisation makes provision for characteristics such as security, reliability, and performance when using a VLS.

- INFLUENTIAL FACTORS_*Pedagogic Factors* (Pedagogic features, Characteristics of online teaching, and Challenges). An understanding of Pedagogic Factors (i.e. the various teaching approaches, instructional design activities, beliefs on the characteristics of online teaching and challenges of online teaching) can form the basis for professional teaching with technology training programmes.
- INFLUENTIAL FACTORS_*Organisational Factors* (e-learning support and challenges) that directly influence the SYSTEM FACTORS corresponding to *Perceived Usefulness*, SYSTEM FACTORS corresponding to *Perceived Importance* and INFLUENTIAL FACTORS_*Pedagogic Factors* and indirectly influence ACTUAL SYSTEM USAGE can be used to understand inadequate support and inhibiting factors (e.g., inequitable access to technology) that pose as challenges or barriers to the success of e-learning. An understanding of organisational support, e.g., resources and user support needed and organisational challenges can form the basis for necessary improvements and/or interventions by management to improve ACTUAL SYSTEM USAGE.
- *Demographic Factors* that influence ACTUAL SYSTEM USAGE with a view to understanding the role of INFLUENTIAL FACTORS_*Demographic factors* (such as system experience and level of study on ACTUAL SYSTEM USAGE. An understanding of these factors can point to and justify the need for customised instructional design/ development support based on level of study and system experience.
- *User Difference Factors* (computer comfort level, teaching style preferences, experiences of online teaching and challenges) that influence ACTUAL SYSTEM USAGE with a view to identifying inhibiting factors. An understanding of inhibiting INFLUENTIAL FACTORS_*User Difference Factors* can be used by managers to make resources available to implement appropriate training and professional development interventions as well as free up educators' time with the ultimate goal of transforming education through innovative use of technology and institutionalising virtual learning systems in higher education.
- ACTUAL SYSTEM USAGE behaviour in respect of *Total System Usage*, *Feature Usage Extent*, *Feature Usage Frequency* and *Usage Clusters* presented in a task-related language that is easily accessible to managers/directors of e-learning or educational technology departments, instructional designers/educational technologists, and system designers alike. Managers /directors of e-learning or educational technology departments can use this knowledge to track current usage trends and re-assess ACTUAL SYSTEM USAGE once training and instructional

design/ development interventions have been implemented in the form of a follow-up usage survey.

10.2.3.2 Designers of VLSs

VLSUM provides knowledge on the following factors that are of value to designers:

- *Perceived Usefulness* related to SYSTEMS FACTORS_*Functions/Features* that directly influenced ACTUAL SYSTEM USAGE. This knowledge by designers to identify the need for additional functions to be implemented in future upgrades by designers.
- *Perceived Importance* related to SYSTEMS FACTORS_*Non-functional Characteristics*, which can be used by designers to identify the list of Non-functional Characteristics for example usability, reliability, performance, security etc. deemed important, to be integrated (if non-compliant) in future upgrades.
- *Pedagogic Factors* (Pedagogic features and Characteristics of online teaching), which can be used by designers to integrate additional pedagogic features and characteristics of online teaching in future upgrades with the goal of providing a better fit with the didactic/instructional tasks to be performed.

This study's empirical findings on user/educator needs relating to *Functions/ Features*, *Non-functional Characteristics* and *Pedagogic Factors* would assist designers of VLSs to initiate design improvements and incorporate additional services. In summary, systems knowledge by way of a feature set can be used by designers to align/ adjust future upgrades of VLSs in line with the perceived user/educator needs in respect of missing functions/features, pedagogic features, and non-compliant system characteristics.

10.2.3.3 Instructional designers/ educational technologists

VLSUM provides knowledge on the following factors that are of value to instructional designers/ educational technologists:

- *Pedagogic Factors* (Pedagogic Features, Characteristics of Online Teaching, and Challenges) can be used by instructional designers to understand required pedagogic features, beliefs on the characteristics of online teaching, and challenges in order to support educators in the design of online courses in keeping with preferred teaching methods and instructional design activities in order to actuate the characteristics of online teaching.

10.2.3.4 Researchers

VLSUM can benefit researchers as an appropriate model for utilisation studies. VLSUM provides a comprehensive usage model representing the influence of factors from various dimensions (system, pedagogic organisational, user difference, and demographic) that can be tested in future empirical studies on any class of virtual learning system. Possible extensions to the model in the form of moderator and mediator variables can be incorporated and statistically tested in future studies.

VLSUM provides confirmation of a framework for utilisation research comprising system design variables, information system characteristics, individual differences and task characteristics.

10.2.4 Contribution to body of knowledge

The following sub-sections present a discussion on the contribution of this research to the scientific body of knowledge.

10.2.4.1 Testing assumptions of underlying theories

The scientific contribution of this study also involved testing assumptions of underlying theories, replicating theories, extending existing models and synthesising theories from different fields. This section describes the main referent theories used for this utilization study and identifies the different models that are conceptually similar to this study. These models were identified and described in Chapter 4, section 4.2.

The main referent theories customised for this study were Markus's three theories (as discussed in Myers and Avison (2002)), namely, system-determined, interaction and people-determined. The constructs (concepts) from different models, namely, TRA, TPB, TAM/TAM2, UTAUT and the adapted innovation diffusion theory are conceptually related to the concepts comprising the SYSTEM FACTORS, *Perceived Usefulness*, *Perceived Importance*, *Pedagogic*, *Organisational*, *User difference* and *Demographic Factors* investigated in this study. The conceptual relationships between concepts of these different models and the concepts underlying the factors of this study were discussed in Chapter 4, section 4.2.

According to Markus, as discussed in Myers and Avison (2002:22), "the basic assumptions underlying the theories can be examined and compared with facts in the real world". The assumptions underlying system utilisation, summarised in Table 10.1, have been adapted from Markus's competing theories of system resistance, namely, system-determined, interaction, and people-determined to study the effect of enabling and inhibiting factors on ACTUAL SYSTEM USAGE. The facts in the 'real world' were factors that influence usage of VLSs as an innovation in higher education. Accordingly, five categories were selected for the purposes of this study. The first category hypothesized *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features* as enabling factors and SYSTEM FACTORS_*Challenges* as inhibiting factors. The second category hypothesized the *Perceived*

Importance of SYSTEM FACTORS_*Non-functional Characteristics* as enabling factors, while non-compliance of SYSTEM FACTORS_*Non-functional Characteristics* was hypothesised as inhibiting factors. The third category hypothesized *Pedagogic Factors*: Pedagogic Features and *Pedagogic Factors*: Characteristics of Online Teaching as enabling factors and Pedagogic Factors: Challenges as inhibiting factors. The fourth category hypothesized *Organisational Factors*: e-learning Support as enabling factors and *Organisational Factors*: Challenges as inhibiting factors. The fifth category hypothesized *User Difference Factors* that can be enabling or inhibiting. The sixth category hypothesized *Demographic Factors* that can be enabling or inhibiting.

Table 10.1: Assumptions underlying system utilisation

Factors	Enabling / inhibiting effect of Factors on ACTUAL SYSTEM USAGE	Assumptions about usage
SYSTEM FACTORS and concomitant factors of *Perceived Usefulness* and *Perceived Importance*	Enabling effect based on perceived usefulness of the system's functions/ features for online teaching. viz.: • Course administration • Communication • Assessment • Content creation, delivery and management • Student productivity and involvement • Student tracking. *Enabling/ inhibiting effect* of Perceived Importance of compliant/non-compliant system characteristics, viz.: • Non-functional system characteristics. *Inhibiting effect* of System challenges.	Usage is a product of the user perceptions and system design functions/features and characteristics.
Pedagogic Factors	*Enabling effect* of integrated Pedagogic Factors: • Pedagogic features • Characteristics of online teaching. Inhibiting effect of: Challenge.	Usage is a product of the task domain, users and system design features and characteristics.
User Difference Factors	*Enabling /inhibiting effect* of individual user characteristics: • Computer comfort and knowledge • Teaching style preference • Experiences of online teaching. • Challenges.	Usage is an attribute of intended user, which can produce desirable/undesirable behaviour.
Organisational Factors	*Enabling effect* of: • Organisational e-learning support. *Inhibiting effect* of • Challenges.	Usage is a product of the organisational setting and users.
Demographic Factors	Enabling or inhibiting effect of: • Experience with target system • Level of study.	Usage is a product of the task domain and users.

The *Perceived Usefulness* concept of TAM is incorporated within the SYSTEMS FACTORS_*Functions/ Features* that were hypothesized to influence ACTUAL SYSTEM USAGE. The perceived ease of use concept is incorporated in the SYSTEMS FACTORS_*Non-functional Characteristics*. The facilitating conditions concept of UTAUT is incorporated within the *Organisational Factors*: e-learning support. The compatibility with one's preferred work style construct, as proposed by Karahanna (2006), from Rogers (1995) innovation diffusion model, is incorporated into the *User Difference Factors*: Teaching style preference. Another concept, included under the *User Difference Factors* is Computer comfort as the role of computer self-efficacy, has been demonstrated to influence ACTUAL SYSTEM USAGE. System experience was incorporated as a concept under *Demographic Factors* as the role of experience in the web-based tools faculty employ was highlighted in the literature.

This study does not test for the relationships between perceived usefulness and perceived ease of use on intention to use and the relationship between intention to use and usage behaviour as these relationships in the TAM model have been empirically tested and proven in many studies (Davis, 1989). The TRA determinants of behavioural intention, namely, attitude and subjective norm were not considered as these are determinants of behavioural intention relevant for systems acceptance studies. The focus of this study is post adoptive usage behaviour where the target systems have already been adopted within the respective organisations, and the participants/respondents of this study have been using the target software for over a year. This study draws from system-determined, interaction and people-determined theories; external factors (system characteristics); perceived usefulness and perceived ease of use constructs from TAM; facilitating conditions and level of experience concepts from UTAUT; the compatibility construct from Karahanna (2006) and the users' satisfaction (positive user experience) concept from Bhattacherjee (2001).

10.2.4.2 Replicating theories

This study replicates theories from other domains, namely, management information system (MIS) implementation and information technology adoption and usage, and applies them to the field of VLS utilisation. VLSUM replicated the general concepts espoused in models such as TAM, UTAUT, task-technology fit and the innovation diffusion theory, which are applicable to the acceptance and usage of various technologies. VLSUM is advocated as a model for organisation-wide usage of VLS technology.

10.2.4.3 Extending existing models

VLSUM extends the existing technology adoption and usage models as follows:

- This study extended the work of McGill et al. (2008) on VLS utilisation as a dependent variable by examining the extent and frequency of educator utilisation of individual VLS functions for online teaching. This study matched tasks requirements for teaching with the functions/features of

VLS technology by analysing instructors' perceptions on the *Perceived Usefulness* of the individual functions/features. This research modelled the tasks, technology and individual differences that were not covered in the study of task-technology fit by McGill et al. It also extended McGill et al.'s work by examining the role of pedagogy in the technology usage.

- An assertion of TRA, from an IS perceptive, is that any other factors that influence usage behaviour do so only indirectly by influencing attitude, subjective norm or their relative weights. Variables such as system design, user characteristics, task characteristics, and nature of the development or implementation process, political influences, and organisational structure fall into this category. This study is departing from TRA by testing for the direct influence of these factors on system usage.
- In TPB, perceived behavioural control is theorized to be an additional determinant of intention and behaviour (Venkatesh et al., 2004). This study extended the concept of behavioural control, which is defined as "the perceived ease or difficulty of performing the behaviour", as discussed in Venkatesh et al. (2004), by including other system characteristics such as reliability, security, etc., that influence usage behaviour.
- In TAM, Perceived Usefulness is theorised to be affected by external variables and EOU in so far as it contributes to improved work performance. Perceived ease of use is also theorized to be determined by external variables. This study expands on TAM by decoupling the external variables into 4 different categories of factors, namely, the Perceived Usefulness corresponding to SYSTEM FACTORS_*Functions/Features*; Perceived Importance corresponding to SYSTEM FACTORS_*Non-functional characteristics*, Pedagogic Factors, and Organisational factors testing the relationships between each factor and ACTUAL SYSTEM USAGE.
- The compatibility construct in Roger's innovation diffusion model is extended by examining the influence of working (teaching) style on system usage.
- The role of experience, as a moderating factor in UTAUT, is examined in this study as an influencing factor of ACTUAL SYSTEM USAGE.
- The role of user satisfaction in the research model by Bhattacherjee (2001) is posited as the positive user experiences of online teaching that are positively correlated with VLS usage.

10.2.4.4 Synthesising theories from different fields

Virtual learning systems have been researched from many perspectives namely functionality for e-learning; support for standards; support for non-functional system characteristics; relative advantages of virtual learning environments; integration of pedagogic features; institutional support; user characteristics and experiences, and task-technology fit.

This sub-section discusses how the VLSUM has advanced the current state of models in the field of virtual learning system usage in higher education. The model draws on research from systems design, human-computer interaction, pedagogy, and the implementation of VLSs. VLSUM customises theories and integrates concepts from different models to develop a conceptual model representing factors that influence virtual learning system usage in higher education. The integration of these concepts can be summarised as follows:

- Integration of Markus's three theories, namely, system-determined, interaction and people-determined where the underlying assumptions have been customised to study utilisation behaviour.
- Integration of the 'other factors' category in TRA that indirectly influence usage behaviour, namely, system design, user characteristics, task characteristics, and the nature of the implementation process.
- Integration of the TPB (theory of planned behaviour) determinant of perceived behavioural control, which is "the perceived ease or difficulty of performing the behaviour".
- Integration of the main determinants of perceived usefulness (PU) and perceived ease of use (PEOU) in TAM as well as the external variables that influence PU and PEOU, namely, system characteristics, training, and user support consultants. According to Hubona, Kennick and Stanley (1996:173), "the external variables, both individual and organisational , are an important consideration with respect to the process of adopting new information technologies. Both the indirect and the direct effects of these external variables on user behaviour must be considered".
- Integration of cognitive instrumental processes found consistent in TAM2 implying that "judgments about a system's usefulness are affected by an individual's cognitive matching of their job goals with the consequences of system use" (Venkatesh & Davis, 2000:199).
- Integration of "Performance expectancy (the degree to which an individual believes that using the system will help him or her to attain gains in job performance)", "effort expectancy (degree of ease associated with the use of the system)" and "facilitating conditions (degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system)" in UTAUT as well as the role of experience (Venkatesh et al., 2004:447-453).
- Integration of the relative advantage, compatibility, complexity determinants from Rogers's innovation diffusion theory.
- Integration of the task-technology fit model postulating that a "better fit among three main determinants, namely, technology functionalities, task requirements, and individual abilities will lead to better performance (i.e., faster or more effective task accomplishment)" (Goodhue, 2009:1828).

10.3 Product contribution

Product contribution involved the design of the following research instruments, namely, the interview schedule, questionnaire, and model confirmation interview following an extensive literature survey on each of the sections constituting the first two instruments.

10.3.1 Interview schedule

An interview schedule (Refer to Appendix 1) was designed, which was used to conduct interviews with educators, collect qualitative data and perform qualitative analysis. The interview schedule was divided into the following sub-sections:

- VLS functions and services needed for online teaching and learning
- Non-functional or quality requirements needed in virtual learning systems
- Pedagogic aspects for online teaching and learning with a VLS
- Institutional e-learning capabilities/support
- E-learning challenges and limitations.

10.3.2 Questionnaire

A comprehensive questionnaire (Refer to Appendix 2) was designed, which was used to conduct surveys with a larger sample of educators, collect quantitative data and perform quantitative analysis. The questionnaire was divided into the following sub-sections:

- General demographic data
- Educator's attitudes and perceptions with regards to online teaching and learning using a VLS
- Support for teaching and learning in a VLS
- Nature and extent of VLS utilisation
- Functions/features deemed useful for online teaching and learning
- Importance of non-functional characteristics for a VLS
- Institutional support for online teaching and e-learning
- Challenges/barriers to online teaching and learning.

10.3.3 Model confirmation instrument

A model confirmation instrument (Refer to Appendix 3) was designed to test the relevance and accuracy of components and relationships between factors in the model. The model confirmation instrument was divided into the following sub-sections:

- Relevance of the INFLUENTIAL FACTORS component and relationships to other VLSUM components
- Method for using the VLSUM model by managers/directors of e-learning or educational technology departments
- Confirmation of the composition of each of the INFLUENTIAL FACTORS of VLSUM and the ACTUAL SYSTEM USAGE component
- Usefulness of information/ knowledge on *Organisational*, *Pedagogic*, *User difference* and *Demographic Factors*.

Researchers can adopt, customise and use one or more parts of these instruments for future studies of acceptance and usage of virtual learning systems in organisations.

10.4 Summary

This chapter provided a discussion of the scientific and product contribution of the study. The discussion on the scientific contribution involved the application of VLSUM, comparison of VLSUM with other acceptance and usage models for this class of software to demonstrate how VLSUM advanced the current state of models in the field of virtual learning system usage in higher education, usefulness of VLSUM to managers of educational technology departments, instructional designers/ educational technologists, system designers, and researchers. In addition, the scientific contribution involved testing the assumptions of underlying theories, replicating theories, extending theories and synthesising theories. The discussion on the product contribution of the study covered the design of the following products, namely, the interview schedule, questionnaire and model confirmation instrument.

The next chapter provides the conclusion and recommendations for the study.

CHAPTER 11: CONCLUSION AND RECOMMENDATIONS

11.1 Introduction

This chapter provides a summary of the study undertaken in terms of the research problem; the role of the literature; the research main and sub-questions; findings; reflections on methods and scientific theories used; and recommendations for future research. The phenomenon being investigated in this study is virtual learning system (VLS) usage in higher education. According to Burton-Jones and Straub (2006:229), researchers in the domain of IS acceptance, study system usage as a behaviour determined by "social and cognitive variables, with the goal of finding variables that explain most variance in usage". System, interaction, individual differences, task-technology fit, compatibility, and facilitating conditions variables have also been used to study system usage behaviour (Davis, 2008; Goodhue, 2009; Karahanna, 2006; Nanayakkara, 2007; Rogers, 1995; Venkatesh, Morris, Davis, & Davis, 2004; Burton-Jones & Hubona, 2005).

11.2 Summary of research

According to Meerts (2003:1), a VLS 'provides an instructor with a set of tools and a framework that allows the relatively easy creation of online course content and the subsequent teaching and management of that course including various interactions with students taking the course'. VLSs offer a variety of functions/features with the expectation that it should provide more choices and increase the use of the system. However, studies about the actual use of VLSs revealed that instructional functions, such as 'publishing syllabi, sending email, and providing readings', were used more frequently whilst the 'communicative and interactive features' were used infrequently, as discussed in Yueh and Hsu (2008:60). The general problem focused on the lack of widespread acceptance and usage of e-learning tools and technology via the medium of VLSs in residential institutions of higher education to support teaching and learning activities/tasks and management of courses in South Africa. The literature was reviewed to identify a core set of existing VLS functions/features, as well as functions/features of closely related technologies such as learning content management systems (LCMS) and web 2.0 tools for inclusion in the SYSTEM FACTORS section of the research instruments. The ACTUAL SYSTEM USAGE component was used to answer the first research sub-question of the study. The SYSTEM FACTORS component corresponding to the INFLUENTIAL FACTORS component was used to answer the second research sub-question of the study. The specifications describing the functions/features of Blackboard and Moodle discussed in Chapter 3 provided a framework and context for identifying and analysing additional functions needed and challenges experienced by users (educators) with regards to the respective VLSs. Knowledge of additional functions/ features and system challenges would give designers the insights needed on future design improvements. In addition, literature on the non-functional system characteristics was used to ascertain which system characteristics were deemed important by educators in higher education. This knowledge would help designers to identify non-compliant system characteristics and address them in future upgrades of systems. Existing literature was reviewed to identify the characteristics of online teaching and pedagogic features constituting the *Pedagogic Factors* that formed part of the scope of the study. This knowledge was used to develop questions pertaining to the *Pedagogic Factors* section of the research instruments. The *Pedagogic Factors* component was used to answer the third research sub-question of the study. Literature findings also pointed to the potential influence of *Organisational Factors*, namely, e-learning support and Challenges on ACTUAL SYSTEM USAGE, which were used to develop questions on the *Organisational Factors* section of the research instruments. The *Organisational Factors* were used to answer the fourth research sub-question of the study. The literature on the effect of user characteristics and user difference on ACTUAL SYSTEM USAGE was used to develop questions pertaining to the *User difference Factors* section of the research instruments. The *User difference Factors* were used to answer the fifth research sub-question of the study. The inclusion of *Demographic Factors* in the survey research instrument was used to answer the sixth research sub-question of the study.

11.2.1 Research questions

The research main and sub-questions for the study are repeated in this section.

This research study was guided by the main research question, namely:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

In order to address the main research question the following research sub-questions were included:

1. What is/are the extent of usage, frequency of usage, total system usage and usage clusters for VLSs in higher education?
2. What system factors corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?
3. What pedagogic factors influence actual system usage in higher education?
4. What organisational factors influence actual system usage in higher education?
5. What user difference factors influence actual system usage in higher education?
6. What demographic factors influence actual system usage in higher education?

11.2.2 Answers to research sub-questions

A summary of the answers/findings for these questions is presented in sub-sections 11.2.1.1 through to 11.2.1.6.

11.2.2.1 Actual system feature usage extent, frequency, and clusters

This section summarised the results for the first research sub-question, namely, 'What is/are the extent of usage, frequency of usage and usage clusters for VLSs in higher education?' The extent or scope of VLS usage included all the 26 functions surveyed with frequency levels ranging from 'not at all' scored at 1 to 'usually' scored at 5. Approximately a third of the VLS functions displayed high usage, while two-thirds of VLS functions displayed lower than average usage for the institution DUT, as described in Chapter 7, section 7.3.1.

Approximately one-fifth of the VLS functions displayed high usage, while four-fifths of VLS functions displayed lower than average usage for the institution UKZN, as described in Chapter 7, section 7.3.2.

The ACTUAL SYSTEM USAGE clusters identified were communication features; management features; content features; and pedagogic features. These usage clusters were depicted in Chapter 7, Table 7.19.
The 'content cluster' of features was used more than the other clusters. Analysis showed that the average usage for DUT of the 'pedagogic cluster' of features was significantly greater than that of UKZN as discussed in sub-section 7.3.4.2. There was no significant difference in the usage of the communication and management cluster of features between the two institutions, DUT and UKZN. The communication cluster displayed average usage, while the management cluster displayed lower than average usage.

11.2.2.2 The influence of concomitant factors namely SYSTEM FACTORS, *Perceived Usefulness* and *Perceived Importance* on ACTUAL SYSTEM USAGE

This section summarised the results for the second research sub-question, namely, 'What SYSTEM FACTORS corresponding to concomitant factors of perceived usefulness and perceived importance influence actual system usage in higher education?' The cluster analysis performed on interview data and correlation analysis performed on survey data indicated that the SYSTEM FACTORS_*Function/ Features* corresponding to the concomitant factors of *Perceived usefulness* influenced ACTUAL SYSTEM USAGE. Hence, the SYSTEM FACTORS_*Function/Features* corresponding to the concomitant factors of *Perceived usefulness* were one of the contributing factors of ACTUAL SYSTEM USAGE. The survey findings corroborated the interview findings.

The cluster analysis performed on interview data indicated that the SYSTEM FACTORS_*Non-functional Characteristics* (e.g., usability, reliability, performance, security etc.) corresponding to the concomitant factors of *Perceived Importance* influenced ACTUAL SYSTEM USAGE. The survey findings did *not* show a positive correlation between *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* (e.g., usability, reliability, performance, security etc.) and ACTUAL SYSTEM USAGE. However, there was a positive correlation between the *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/ Features,* which were a contributory factor of ACTUAL SYSTEM USAGE. One can infer from this correlation that *Perceived Importance* corresponding to the SYSTEM FACTORS_*Non-functional Characteristics* indirectly influenced ACTUAL SYSTEM USAGE.

11.2.2.3 The influence of *Pedagogic Factors* on ACTUAL SYSTEM USAGE

This section summarised the results for the third research sub-question, namely, 'What pedagogic factors influence actual system usage in higher education?' The cluster analysis performed on interview data and correlation analysis performed on survey data indicated that *Pedagogic Factors* influenced ACTUAL SYSTEM USAGE. The survey findings further indicated that *Pedagogic Factors:* Characteristics of online teaching were positively correlated with ACTUAL SYSTEM USAGE. Hence one can conclude that *Pedagogic Factors:* Characteristics of online teaching were a direct contributory factor of ACTUAL SYSTEM USAGE.

The survey findings also indicated the following positive correlations among the *Pedagogic Factors*:

- *Pedagogic Factors:* Pedagogic features and *Pedagogic Factors:* Characteristics of online teaching
- *Pedagogic Factors:* Challenges and *Pedagogic Factors:* Pedagogic features.

One can infer from these correlations that *Pedagogic Factors:* Pedagogic features indirectly influenced ACTUAL SYSTEM USAGE. Survey findings also indicated that while *Pedagogic Factors:* Challenges were not statistically correlated with ACTUAL SYSTEM USAGE, they were positively correlated with *Pedagogic Factors:* Pedagogic features, which, in turn, were positively correlated with *Pedagogic Factors:* Characteristics of online teaching, a direct contributory factor of ACTUAL SYSTEM USAGE.

11.2.2.4 The influence of *Organisational Factors* on ACTUAL SYSTEM USAGE

This section summarised the results for the fourth research sub-question, namely, 'What organisational factors influence actual system usage in higher education?' While the *Organisational Factors* were found to be positively correlated with ACTUAL SYSTEM USAGE from the cluster analysis performed on interview data, this finding was *not* confirmed by the results of the survey. Hence, one can conclude from the survey findings of this study that *Organisational Factors* were not a direct contributory factor of ACTUAL SYSTEM USAGE. However, the *Organisational Factors* were positively correlated with *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features* and *Pedagogic Factors,* both of which were direct contributory factors of ACTUAL SYSTEM USAGE. One can infer from this that the *Organisational Factors* indirectly influenced ACTUAL SYSTEM USAGE. Survey findings also indicated that the *Organisational Factors:* e-learning support and Challenges were positively related to each other. Strong agreement on statements pertaining to the need for organisational e-learning support was accompanied by strong agreement on organisational challenges/barriers to the success of e-learning, which is an expected outcome.

11.2.2.5 The influence of *User Difference Factors* on ACTUAL SYSTEM USAGE

This section summarised the results for the fifth research sub-question, namely, 'What user difference factors influence actual system usage in higher education?' The results of the cluster analysis performed on interview data and correlation analysis performed on survey data indicated that the *User Difference Factors* influence ACTUAL SYSTEM USAGE. Hence, one can conclude that *User Difference Factors* is one of the contributing factors of ACTUAL SYSTEM USAGE. The survey findings indicated that *User Difference Factors namely,* 'Teaching style preference'; 'Experience of online teaching' and 'Computer comfort level' were positively correlated with ACTUAL SYSTEM USAGE. Hence, one can conclude that the constructs of 'Teaching style preference'; 'Experience of online teaching' and 'Computer comfort level' were direct contributing factors of ACTUAL SYSTEM USAGE. While survey findings indicated that the 'Challenges' construct of the *User Difference Factors* was not correlated with ACTUAL SYSTEM USAGE, it was, however, positively correlated with the construct 'Experience of online teaching'. One can, therefore, infer that the 'Challenges' construct played an indirect role in ACTUAL SYSTEM USAGE. An interesting finding was that a high score on 'Challenges' was correlated with a low score on the 'Experience of online teaching' construct. Hence, a high score on Challenges suggests strong agreement on aspects that pose challenges/barriers to the success of e-learning and negatively impacts on 'Experience of online teaching'.

11.2.2.6 The influence of *Demographic factors* on ACTUAL SYSTEM USAGE

This section summarised the results for the sixth research sub-question, namely, 'What demographic factors influence actual system usage in higher education?' The correlation analysis performed on survey data indicated that the *Demographic Factors* influence ACTUAL SYSTEM USAGE. Survey findings indicated that the following *Demographic Factors* were positively correlated with ACTUAL SYSTEM USAGE:

- Length of use

- Number of courses taught
- Level of study.

Survey findings also indicated that *Demographic Factors* ‘length of use’ and ‘number of online or hybrid courses taught’, collectively identified as ‘System experience’, were positively correlated with *User Difference Factors*: Experience of online teaching.

Experience with using the target system as defined by length of usage and number of courses taught, is positively related to system usage. This is an expected outcome as those respondents who taught >6 courses, showed higher utilization of functions/features than those who taught between 1 and 3 courses. In addition, there is a correlation between ACTUAL SYSTEM USAGE and the *Demographic Factors*: Length of use, which was an expected outcome. This finding supports literature findings.

The finding with regards to Level of Study was as follows: those respondents who lecture mostly postgraduate and some undergraduate have higher usage that those who lecture mostly undergraduate and some postgraduate as well as those who lecture only undergraduate.

The main research question addressed in this section is namely:

What are the components of a conceptual model representing the factors that influence virtual learning system usage in higher education?

In answering this question, a conceptual model representing the factors that influence virtual learning system usage in higher education was presented in Chapter 8, Figure 8.1, accompanied by a description of its components and relationships. The representation of VLSUM is repeated in Figure 11.1

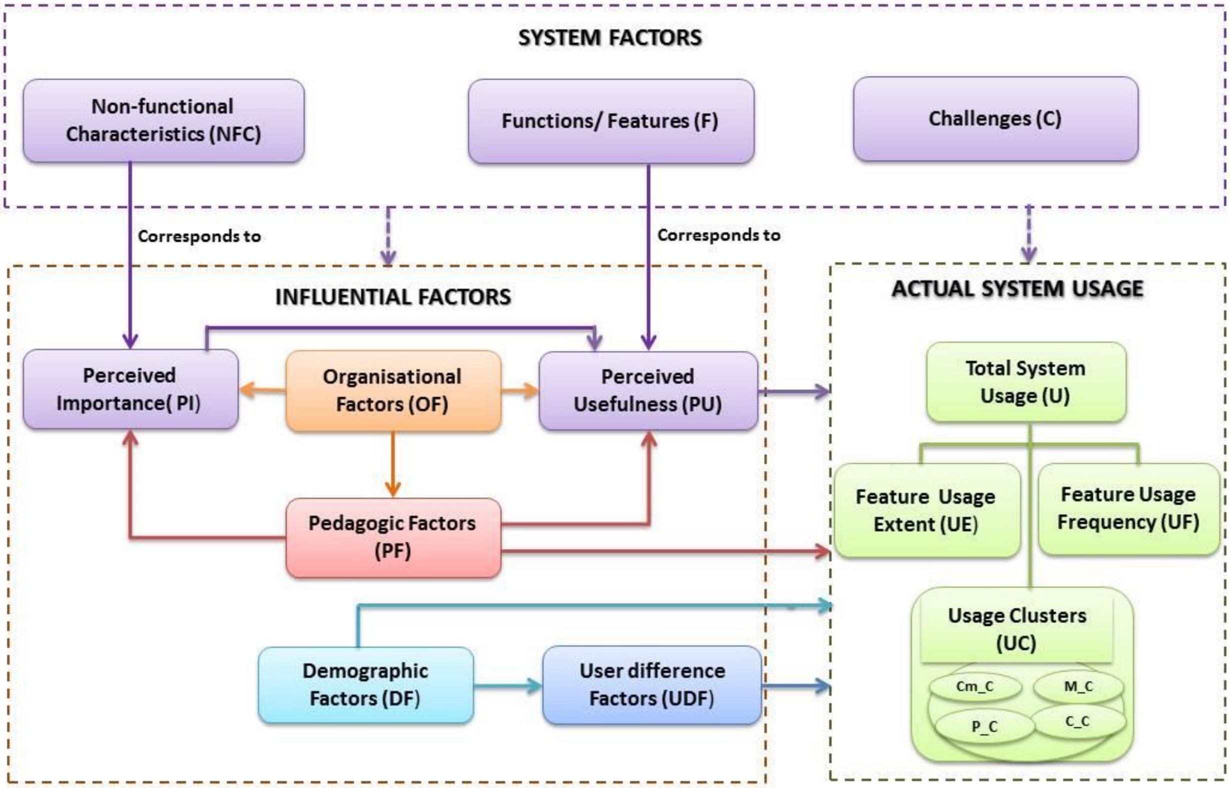

Figure 11.1: Virtual learning System Usage Model (VLSUM)

The three main distinguishing components of VLSUM are:

- The SYSTEM FACTORS component that influences the ACTUAL SYSTEM USAGE component, as illustrated in Figure 11.1 comprises the following factors:
    - *Functions/ Features*
    - *Non-functional Characteristics*
    - *Challenges*.

- The INFLUENTIAL FACTORS component that influence the ACTUAL SYSTEM USAGE component, as illustrated in Figure 11.1 comprises the following factors:
    - *Perceived Usefulness*
    - *Perceived Importance*
    - *Pedagogic Factors*
    - *Organisational Factors*
    - *User Difference Factors*
    - *Demographic Factors.*

- The ACTUAL SYSTEM USAGE component, as illustrated in Figure 11.1 comprises the following sub-components:
  - *Total System Usage*
  - *Feature Usage Extent*
  - *Feature Usage Frequency*
  - *Usage Clusters*.

The methods for using VLSUM by managers/directors of e-learning or educational technology departments, and educational technologists/instructional designers are described in sections 8.4.1 and 8.4.2.

11.3 Reflection

The methodological and scientific reflections are presented in sub-sections 11.3.1 and 11.3.2.

11.3.1 Methodological reflection

The research design used for the study was a case study approach with the institutions DUT and UKZN serving as the two cases for the study. Hence a two case-study design was implemented to investigate factors influencing ACTUAL SYSTEM USAGE in higher education. The study interviewed and surveyed educators as the central agents of e-learning. Hence, the results obtained were presented from the perspective of the educators only. Educators' experience and usage of two VLSs, namely, Blackboard and Moodle deployed at the two higher education institutions formed the basis of this investigative case study. The results of each case study was reported separately followed by a cross case summary. Qualitative and quantitative data sources were used including interviews, surveys, and existing specification documents for the relevant VLS. Thematic and cluster analysis were the techniques used for the analysis of interview data. Descriptive statistics, namely, mean, standard deviations, frequency tables, as well as Cronbach's Alpha, Pearson Product correlations, factor analysis, chi-square tests, t-tests and other measures were used to analyse survey data, which are described in Chapter 5, section 5.6.3.

One of the limitations of conducting a case study approach is the issue of generalising results. According to Walsham (1995:79), "four types of generalization can be made from interpretive case studies: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insight". However, generalization should be viewed as an explanation of "particular phenomena, derived from empirical interpretive research in specific IS settings, which may be valuable in the future in other organizations and contexts" (Walsham, 1995:79). This study used a case study research strategy, combined with a mixed method research design using *multiple methods*, namely quantitative and qualitative approaches (Venkatesh et al., 2013). Accordingly, quantitative data (i.e., surveys) were analysed quantitatively and qualitative data (i.e., interviews) were analysed qualitatively. Generalisation, in this study, was viewed as an explanation of the phenomena of virtual learning system usage in higher education derived from the empirical interpretive research conducted in two VLS settings.

Self-reported measures of computer knowledge and experience can also be a limiting factor. Self-reported measures of system usage are not as accurate as course logs showing activity within a course.

Another limiting factor was the response rate to the survey, which was not as high as expected because the questionnaire instrument was very long.

11.3.2 Scientific reflection

The theories used to stipulate the choice of antecedents included the theory of reasoned action, the theory of planned behaviour, system-determined, interaction, people-determined theories, and the innovation diffusion theory, as discussed in Chapter 4.

The results obtained with regards to the significance of the relationships between SYSTEM FACTORS corresponding to Perceived Usefulness; SYSTEM FACTORS corresponding to *Perceived Importance Pedagogic*; *User Difference* and *Demographic Factors* and ACTUAL SYSTEM USAGE were expected. The result with regards to the *Organisational Factors* being an indirect factor of ACTUAL SYSTEM USAGE was not expected. However, this result supports other empirical findings.

The main contribution of this study to the body of knowledge is the proposed conceptual model VLSUM representing the factors that influence virtual learning system usage in higher education. In addition, the study contributed by testing assumptions of theories, replicating and synthesising existing theories of IS acceptance and usage. This study made a product contribution by way of research instruments developed to study the factors that influenced ACTUAL SYSTEM USAGE in higher education as well as a confirmation instrument for the proposed conceptual model. These research instruments, namely, an interview schedule and questionnaire had to be developed from a comprehensive review of the literature supporting the multiple dimensions of this study.

11.4 Recommendations for further research

The following further research opportunities emerged during the course of this study:

- The VLSUM model can be adopted by higher education institutions to test the influence of SYSTEM and INFLUENTIAL FACTORS on ACTUAL SYSTEM USAGE in other organisations and contexts.
- This research can be conducted for pure distance higher education institutions where is no face-to-face classroom interaction culture.
- Self-reported measures of system usage can be supplemented in future studies by course logs showing activity within a course.
- This study can be approached from a different research dimension, namely, IS implementation by reviewing the implementation process variables that influence ACTUAL SYSTEM USAGE in higher education or IS success by studying the impact of ACTUAL SYSTEM USAGE on individuals or the organisation.

11.5 Final Reflection

Research is a quest for answers to a problem stimulated by a curiosity or interest, which leads to the researcher embarking on a journey of many paths fraught with unknowns to discover truths and eventually arrive at answers / new knowledge / fresh insights while uncovering new questions, thereby continuing the cycle of knowledge creation and evaluation.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANOVA	Analysis of variance
AICC	Aviation Industry Computer-Based Training Committee
ATTLS	Attitudes to Thinking and Learning Survey
CMS	Course management system
COLLES	Constructivist On-Line Learning Environment Survey
ERP	Enterprise resource planning
VLSUM	Educational technology usage model
EUT	Experience with the use of technology
LMS	Learning management system
VLE	Virtual learning environment
VLS	Virtual learning system
LCMS	Learning content management systems
LDAP	Lightweight Directory Access Protocol
ET	Educational technology
HE	Higher education
HEI	Higher education institution
FE	Further education
HCI	Human computer interaction
SE	Software engineering
IS	Information system
ICT	Information and communication technology
ITS	Integrated tertiary system
UKZN	University of KwaZulu-Natal
DUT	Durban University of Technology
IDT	Innovation diffusion theory
MPCU	Model of PC Utilisation
OLS	Online learning system
TAM	Technology acceptance model
UTAUT	Unified Theory of Acceptance and Use of Technology
TBT	Technology-based training
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
TPC	Task to performance technology chain
TTF	Task-technology fit
IM	Instant Messaging
SCORM	Sharable Content Object Reference Model
SSL	Secure socket layer
OSI	Open source initiative
PLE	Personal Learning Environment
PDA	Personal digital assistant
PDP	Personal development planning
PDF	Portable Display Format
VoIP	Voice over internet protocol
WAP	Wireless access protocol
WYSIWYG	What You See Is What You Get
WebDAV	World Wide Web Distributed Authoring and Versioning
RSS	Really Simple Syndication
PHP	open source server-side scripting language designed for web development
HTML	Hypertext mark-up language

RTF	Rich text format
SMS	Student management system
SPSS	Statistical Package for the Social Sciences
URL	Uniform resource locator
OKI	Open Knowledge Initiative

APPENDICES

APPENDIX 1: INTERVIEW SCHEDULE

Interview questions for educators regarding factors that affect virtual learning system (VLS) utilisation to implement e-learning in residential HE institutions

Name:
Gender:
Email Address:
School/Discipline:
Which VLS(s) do you have experience of? (e.g. WebCT, Blackboard, Desire2Learn, Angel, Moodle, etc.) ______________________________.
No of years involved in teaching with a VLS: ____.
Number of online/hybrid courses taught: ________.
Which VLS are you currently using? ___________________.
How long have you been using the current VLS? ____________________.
Describe your general computer experience ___________________.

Question category: VLS functions and services needed for online teaching	
No	**Question**
1.	What **functions of a VLS do you regard as most important for online teaching or the online component of your courses**? (*Asynchronous* ***communication*** *e.g. e-mail, online discussion forums; synchronous communication in real-time e.g. Whiteboards, chats;* ***content delivery****; online* ***assessment****, monitoring students' progress; learning* ***content creation****,* ***organisation of students*** *into groups,* ***notification*** *of different events,* ***announcements, notices****,* ***uploading & sharing*** *of files, online* ***submission of assignments****, wikis, e-mail integration with forum posting etc.…)*
2.	Do you need any **additional functionality that is missing** in the virtual learning system in use? *(E.g. Online marking tool etc. i.e.* ***Limitations of current systems***)
3.	What functions do you regard as important for **course administration/management** with a VLS i.e. what is necessary for using the system properly from an administration perspective? (*E.g. user registration, authentication; course authorization, copying, backup, hiding courses still being developed etc….)*
4.	What **multimedia formats** should be supported by a VLS for effective online teaching and learning? (*E.g.MP3 audio, video…*)
5.	What **facilities** do you need in a VLS for **supporting distance learners in an online course**? (*E.g. videoconferencing, live recordings and real time streaming facilities, multicasting lecture sessions to several sites*)
6.	What **types of tool support** would you find useful when performing **online assessments** and **tracking student progress** with a VLS? (*E.g. automatic marking, importing test questions, custom scales for grading, track students' grades in a course over time, track across students' performance, trace how many discussions students*

	contributed to & rating contributions/postings, associate activities, content and assessment against instructional objectives, activity reports, importing Excel into grade book; exporting grade book to Excel etc…)
7.	What facilities in a VLS do you consider **important for student involvement and productivity** in an online course? (*E.g. threaded discussion forums,* ***s****tudent profiles, online journals, time management/ planning/ organisational tools to organise their work in your course(s)…..)*
8.	What **course constraints (conditions)** do you need to be incorporated into a VLS for the online component of your courses? (*E.g. withholding of assignment/test solutions, etc.)*
9.	Which **functions of a VLS do you regard as important for learning for the students**? (*What is necessary to use the system properly for learning e.g. self-tests, learning portfolios, threaded discussions, chatting, quizzes, peer evaluated assignments, reflective journals, glossary, monitoring their own learning…*)
10.	How could the **students get better online support or support from the lecturer in the online component of a course**? (*What are the missing features of support?*)
11.	What **standards** should a VLS conform to for online teaching and learning? (*E.g. content transfer to/from another vendor's platform, instructional standards, security standards, accessibility standards, etc.)*

Question Category: Non-functional or quality requirements needed in a VLS	
No	**Question**
12.	What quality **characteristics do you believe** should be integrated into a VLS to support the online component of your courses? *(E.g. Easy to learn and use; secure; reliable; flexible; efficient; robust, interoperable (importing and exporting of VLS data), customisable etc.)*

Question Category: Pedagogic aspects for online teaching with a VLS	
No	**Question**
13.	What **pedagogic approach(es)** do you use or deem important in module(s) taught that need to be supported in a VLS? (E.g. *lecturer to learner transmission, socio-constructivist, communities of learning etc.*)
14.	What **pedagogical aspects** should be incorporated into the online component of courses? (*E.g. online learning objectives; mechanisms for online interactions, feedback timeframes, online office hours, student evaluation of online classes etc…)*
15.	What **online learning strategies** do you use or deem important in module(s) taught that need to be supported in a VLS? (E.g. p*roblem solving, role playing, simulations, games, blogging, creating, adding and modifying content in wikis, resource-based learning etc.*)

Question Category: Institutional e-learning capabilities/support	
No	**Question**
16.	What types of **University support** would you find useful for online teaching and learning with a VLS? (E.g. *faculty instructional design support, professional training, workshops, showcasing best practice, technical assistance, access to digital libraries etc.)*
17.	What aspects do you believe are important for **institutional planning and management** of online teaching and learning with a VLS? (E.g. *resources, policy and strategy etc….)*

Question Category: e-learning challenges & limitations	
No	**Question**
18.	What do you perceive to be the **challenges with successful implementation of e-learning** in South African higher education institutions? *(E.g. physical infrastructure and computer literacy etc.)*
19.	What aspects of traditional face to face education in South African residential higher education institutions are difficult to address with E-learning? (***Limitations of e-learning approach***)
20.	What problems do you perceive with SA students coming from diverse educational backgrounds adapting to the e-learning approach in higher education? (***Problems based on experiences in the way of learning****)*

APPENDIX 2: QUESTIONNAIRE

Questionnaire for lecturers regarding factors that affect educator's utilisation of a virtual learning system (VLS) to integrate e-learning practices

Section 1: General

1. What is the name of the University/Institution at which you are currently employed (e.g. UKZN, DUT)? ___________________.

2. What is the current name of the school//department in which you teach (for example management, fine arts, engineering, nursing, education, information systems and technology etc.)? ___________________________________.

3. What is your **e-mail address**? (optional)_________________________.

4. What is your **current academic rank**?
   - ☐ Lecturer
   - ☐ Senior Lecturer
   - ☐ Associate Professor
   - ☐ Professor
   - ☐ Other. Specify _________________.

5. What level(s) of study do you lecture?
   - ☐ Undergraduate courses only
   - ☐ Postgraduate courses only
   - ☐ Mostly undergraduate with some postgraduate courses
   - ☐ Mostly postgraduate with some undergraduate courses

6. **I am comfortable with the following: (Tick all that apply)**
   - ☐Creating spreadsheets
   - ☐Using word processing software to create/edit documents and reports
   - ☐Using power point for presentations
   - ☐Writing simple software programs

7. What kind of **teaching style** do you prefer? Tick **only 1 option**
   - ☐A blended approach using face to face and online teaching
   - ☐Traditional face-to face teaching only
   - ☐Online teaching only

8. What is the **name of the virtual learning system (VLS)** that you are **currently using** for your course(s)? If you are NOT currently using a **VLS** name the one you **used most frequently** in the past. Provide ONLY 1 name.

☐WebCT
☐Online Learning System (OLS)
☐Moodle
☐Blackboard
☐Atutor
☐Other. Specify ___________________________________.

9. How **long** have you been using the VLS identified in question 8?

☐Less than 1 year
☐From 1 to less than 3 years
☐From 3 to less than 5 years
☐5 years or more

10. **Total number of distinct online/hybrid courses taught** in your career:

☐Between 1 and 3
☐Between 4 and 6
☐Greater than 6

Section 2: Educator's attitudes and perceptions with regards to online teaching and learning using a VLS						
11.	**I find the online classroom/ component in a blended teaching environment:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	to be **no different** from traditional face to face delivery for achieving learning outcomes	☐	☐	☐	☐	☐
	more **flexible** in that online delivery can be conducted anywhere at any time whereas traditional face to face teaching is constrained by location and time	☐	☐	☐	☐	☐
	requires more **planning and effort** than traditional face to face teaching	☐	☐	☐	☐	☐
	more **learner centred** whereas traditional face to face teaching is more teacher centred	☐	☐	☐	☐	☐
	requires giving **more support to students** than is required with traditional face to face teaching	☐	☐	☐	☐	☐
	allows **more collaborative learning** than traditional face to face delivery	☐	☐	☐	☐	☐
	allows **better tracking of students' learning progress** in a course than face to face delivery	☐	☐	☐	☐	☐
	allows for **better course management**	☐	☐	☐	☐	☐
	allows **more teaching or instructional strategies** to be used than traditional face to face delivery	☐	☐	☐	☐	☐

12.	**My attitude towards the online classroom/ component as opposed to traditional face to face teaching in a blended environment is:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	I am **comfortable** with the **online classroom/ component** delivery for my courses	☐	☐	☐	☐	☐
	I can **deliver as effectively** with the **online classroom/ component** compared to traditional face to face instruction	☐	☐	☐	☐	☐
	Teaching is **more work with the online classroom/ component** than in traditional face to face education	☐	☐	☐	☐	☐
13.	**Using a VLS to communicate with my students in a blended environment:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	is **easier** than traditional face to face communication	☐	☐	☐	☐	☐
	requires **more communication**	☐	☐	☐	☐	☐
	requires **careful wording** because of the absence of audio/ visual cues	☐	☐	☐	☐	☐
	maintains a **record of conversations**/ discussions/agreements/arrangements for later retrieval	☐	☐	☐	☐	☐

Section 3: Support for teaching and learning in a VLS						
14.	The following **pedagogic aspects should be supported in the online classroom/ component for my subject/discipline:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Promote an **expert's point of view**	☐	☐	☐	☐	☐
	Disseminate knowledge from lecturer to learner	☐	☐	☐	☐	☐
	Structured, guided learning activities	☐	☐	☐	☐	☐
	Active learning engagement (e.g. discussions, lessons, quizzes, problem solving, learning portfolios, peer evaluations etc.)	☐	☐	☐	☐	☐
	Differentiated instruction to cater for differing levels of computer literacy, information literacy and English language proficiency	☐	☐	☐	☐	☐
	Instruction to cater for different **learning styles**	☐	☐	☐	☐	☐
	Situated and contextual learning (i.e. allow teachers and students to seamlessly integrate real-world authentic activities)	☐	☐	☐	☐	☐
	Allow students to **post reactions/ reflections** to specific topics	☐	☐	☐	☐	☐
	Provide students with the **tools to discuss** and explain their own ideas and develop and refine documents in groups	☐	☐	☐	☐	☐
	Reflection on the learning process (e.g. journal keeping, probing questions to reflect on etc.)	☐	☐	☐	☐	☐

	Allow individual students to support one another in **co-constructing** the facts, knowledge, and processes of a content area or discipline	☐	☐	☐	☐	☐
	Communicate **rules and procedures** for online course activities and discussions	☐	☐	☐	☐	☐
	Elicit **student feedback** on quality and effectiveness of e-learning experience	☐	☐	☐	☐	☐

Section 4: Nature and extent of VLE utilisation						
15.	**Which of the following VLS functions/features have you utilised for your courses and to what extent?**	**Not at all**	**Rarely**	**Sometimes**	**Often**	**Usually**
	Presenting course information (e.g. study guides, course outlines, timetables etc.)	☐	☐	☐	☐	☐
	Posting course content (e.g. notes, PowerPoint presentations; external links to other sources of content tutorials; past exams solutions etc.)	☐	☐	☐	☐	☐
	E-mail communication	☐	☐	☐	☐	☐
	Online real-time chat with students	☐	☐	☐	☐	☐
	Online threaded discussion forum	☐	☐	☐	☐	☐
	Shared whiteboard	☐	☐	☐	☐	☐
	Blogs	☐	☐	☐	☐	☐
	Wikis (internal/ external) for collective authoring of documents	☐	☐	☐	☐	☐
	Course announcement/ notices/ news	☐	☐	☐	☐	☐
	Course calendar and schedule	☐	☐	☐	☐	☐
	Online glossary	☐	☐	☐	☐	☐
	File exchanges	☐	☐	☐	☐	☐
	Student online journals	☐	☐	☐	☐	☐
	Online quizzes/self-tests	☐	☐	☐	☐	☐
	Online test(i.e. credit bearing)	☐	☐	☐	☐	☐
	Online assignment submission	☐	☐	☐	☐	☐
	Online marking of assessments/ activities with grading and comments	☐	☐	☐	☐	☐
	Peer reviews of student posts	☐	☐	☐	☐	☐
	Grading of peer reviews	☐	☐	☐	☐	☐
	Peer evaluation of assignments	☐	☐	☐	☐	☐
	Tracking student participation in online discussion forums	☐	☐	☐	☐	☐
	Grading student participation in online discussion forums/blogs	☐	☐	☐	☐	☐
	Creating lessons	☐	☐	☐	☐	☐
	Publishing marks in grade book	☐	☐	☐	☐	☐
	Online surveys	☐	☐	☐	☐	☐
	Online polls (to vote on something; research consent)	☐	☐	☐	☐	☐

Section 5: Functions/features deemed useful for online teaching and learning								
16.	The following **communication and collaboration services/capabilities** are useful for the online classroom/ component of the courses you teach**:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Discussion Forum (e.g. post in forums, attach files, insert URLs, view discussions by thread/ date/post, search threads, formatting text editor for mathematical equations, spell- checking etc.)	☐	☐	☐	☐	☐	☐
	Discussion management (e.g. create discussion groups, screen posts, view statistical summaries of participation, enable peer review of posts, enable/ disable anonymous posting, notify participants of new posts etc.)	☐	☐	☐	☐	☐	☐
	Real time chat (e.g. create chat rooms, allow simultaneous group chats, moderate chats, suspend students from chat rooms, support URLs, images, embedded HTML in chats, archive chat logs etc.)	☐	☐	☐	☐	☐	☐
	Internal Email (i.e. built-in email service)	☐	☐	☐	☐	☐	☐
	Webinar capability for remote training (i.e. educators can lead students through lessons and exercises with integrated online testing)	☐	☐	☐	☐	☐	☐
	Blogging capability	☐	☐	☐	☐	☐	☐
	Internal wiki capability for collaborative student work	☐	☐	☐	☐	☐	☐
	Video and/or voice conferencing	☐	☐	☐	☐	☐	☐
	File exchanges (private folders, shared group folders for sharing content with other students)	☐	☐	☐	☐	☐	☐
	Whiteboard to support mathematical symbols and image and PowerPoint uploading	☐	☐	☐	☐	☐	☐
17.	The following **types of tool support** are useful for performing **online assessments** and student **tracking:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Test Types(e.g. allow variety of test types, embed media (e.g. images) into test questions, **s**elf-assessment quizzes)	☐	☐	☐	☐	☐	☐
	Automated Testing Management (e.g. question creation, automatic marking of objective type questions, dates and times when students must access tests; randomising questions and answers; multiple attempts for quizzes; MathML editor for mathematical formulas in both questions and answers, etc.)	☐	☐	☐	☐	☐	☐
	Automated Testing Support(importing questions from existing test banks, statistical analysis of test results)	☐	☐	☐	☐	☐	☐

	Online Marking Tools (e.g. instructors can mark paragraph questions and return student assignments through the assignment drop box, provide comments/feedback through annotations)	☐	☐	☐	☐	☐	☐
	Online Grade book (e.g. keep track of student progress and work online in support of assigning course marks, student view of their marks for assignment/ tests etc.)	☐	☐	☐	☐	☐	☐
	Online Grade book management (e.g. automate entries for new assessments, add grades of offline assignments/tests, custom grading scales, weight tests/ assignments, test item analysis, manually edit grades, sort grades, search grade book, download and upload grade books in common formats like Excel etc.)	☐	☐	☐	☐	☐	☐
	Integrate feedback with the grade book	☐	☐	☐	☐	☐	☐
	Online assignment(e.g. date-stamped assignments, assignment drop boxes, allow multiple files for assignment, track student assignment submissions, submit group assignments, set deadlines for assignments, allow late assignments, re-submit assignments for re-grading, integration of grading forms preloaded with marking criteria and weighting etc.)	☐	☐	☐	☐	☐	☐
	Check student work submitted is not plagiarised	☐	☐	☐	☐	☐	☐
	Student tracking (e.g. track frequency and date student accessed individual course components, what they have read what they have posted, students at risk etc.)	☐	☐	☐	☐	☐	☐
18.	The following facilities are useful for **productivity and student involvement** in the online classroom/ component of courses:	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Calendar (e.g. students and instructors can post events in the course calendar, instructors can post announcements etc.)	☐	☐	☐	☐	☐	☐
	Bookmark management	☐	☐	☐	☐	☐	☐
	Searching within a course (e.g. students can search all discussions, chats based on key words etc.)	☐	☐	☐	☐	☐	☐
	Subscribe to RSS feeds to be notified of changes to materials	☐	☐	☐	☐	☐	☐
	Providing **server work space** to assign specific tasks or projects; saving students' work	☐	☐	☐	☐	☐	☐
	Working Offline by downloading course content to local computers and for work to be synchronized into the course the next time student logs-in	☐	☐	☐	☐	☐	☐
	Orientation/Help tools (e.g. online tutorials/user manuals, e-mail support that	☐	☐	☐	☐	☐	☐

	help students how to use the system etc.)						
	Group work (e.g. instructor created groups, group discussion forum, group chat, shared file exchange, group e-mail lists, group specific activities/assignments etc.)	☐	☐	☐	☐	☐	☐
	Community networking (e.g. to allow students to create study groups)	☐	☐	☐	☐	☐	☐
	Student profiles where students can display their personal photo, and list demographic information	☐	☐	☐	☐	☐	☐
	Student Journal (e.g. private online notes about course, reflect on learning etc.)	☐	☐	☐	☐	☐	☐
19.	The following types of tool support are useful for **online course delivery and management:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Create learning activities/objects (e.g. web pages, glossaries, lesson activities presented in a linear or branching manner etc.)	☐	☐	☐	☐	☐	☐
	Online repository for storing learning content/objects	☐	☐	☐	☐	☐	☐
	O**rganise learning objects, course tools and content into learning sequences** that are reusable	☐	☐	☐	☐	☐	☐
	Enabling separate e-Reserves folders for every course (which are digital versions of copyright-cleared reserve readings that libraries create for faculty and students)	☐	☐	☐	☐	☐	☐
	File management (zip, unzip, rename, move etc.)	☐	☐	☐	☐	☐	☐
	Display of any electronic content viz. Word, Excel, PowerPoint, PDF , MP3 audio, Video stored locally or remotely	☐	☐	☐	☐	☐	☐
	Versioning to allow users to automatically archive and track previous versions of their files	☐	☐	☐	☐	☐	☐
	Workflow activities to provide users with the ability to route content to others for review or approval, designating settings such as priority, deadline, and permissions	☐	☐	☐	☐	☐	☐
	Content Authoring features such as a WYSIWYG (What You See Is What You Get) editing tool that provides a rich text editing interface similar to a word processor	☐	☐	☐	☐	☐	☐
	Adaptive Release whereby instructors can create custom learning paths by determining when students can access content items, assessments, assignments or other learning activities	☐	☐	☐	☐	☐	☐

20.	The following types of **tool support were useful for online course administration:**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Registration integration (e.g. instructors can manually add students to courses, import class list, administrators can populate registered students into courses)	☐	☐	☐	☐	☐	☐
	User management (e.g. delete old class lists, manually add users and roles, add multiple teachers for course, reset user passwords etc.)	☐	☐	☐	☐	☐	☐
	Allow **guest access**	☐	☐	☐	☐	☐	☐
	Maintain **student records**	☐	☐	☐	☐	☐	☐
	Allow educator to **preview course** as a student	☐	☐	☐	☐	☐	☐
	Creation, migration and archiving of courses	☐	☐	☐	☐	☐	☐
	User authentication (e.g. via external LDAP sever etc.)	☐	☐	☐	☐	☐	☐
	Course authorisation (e.g. restricting access based on roles of course creator, teacher, student, guest etc.)	☐	☐	☐	☐	☐	☐
	Hiding courses and documents	☐	☐	☐	☐	☐	☐
	Course cloning(copying)	☐	☐	☐	☐	☐	☐
	Backup and **recovery**	☐	☐	☐	☐	☐	☐

Section 6:Importance of non-functional characteristics for a VLS						
21.	The following **characteristics** are important for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	export data (e.g.. making data like marks available to other systems; provide content to digital libraries and other e-learning systems)	☐	☐	☐	☐	☐
	import data (e.g. import class lists from ITS and curricula materials developed by educational and academic publishers, access content from digital libraries and other E-learning systems)	☐	☐	☐	☐	☐
	Seamless integration or links to internal university systems (e.g. University website, library system etc.)	☐	☐	☐	☐	☐
	A **flexible platform** that allows for add-ons with search engines, online books, plagiarism tools and other needed tools (e.g. Flash player)	☐	☐	☐	☐	☐
	Offer both **programme and course level view** of courses	☐	☐	☐	☐	☐
	Offer PC and Wireless/PDA access to course information such as announcements, calendar items and grades	☐	☐	☐	☐	☐
22.	Compliance with the following **standards** were important for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Standard for sharable, durable, and reusable Web-based learning content **(SCORM**)	☐	☐	☐	☐	☐

	Standards that **organise digital resources** into logical learning units; enable **sequencing of activities** within a course(IMS)	☐	☐	☐	☐	☐
	Standard for **common format for information about learners** which can be freely exchanged among systems	☐	☐	☐	☐	☐
	Standard that allows generic ways of **specifying tests** that can be realised in many different systems	☐	☐	☐	☐	☐
	Use of metadata to structure content into objects (e.g. instructional content, multimedia content, assessments etc.) that can be described and tagged for the purpose of reusing, referencing, and controlling the flow and access to information.	☐	☐	☐	☐	☐
	Information security standard	☐	☐	☐	☐	☐
	Accessibility of Web content standard (tools to help visually impaired users e.g. add alt tags on all system images, screen reader technology etc.)	☐	☐	☐	☐	☐
	OpenID standard to access many websites without having to create new passwords for each website	☐	☐	☐	☐	☐
23.	The following **security characteristics** are important for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Identification and authentication of staff and students with username and passwords	☐	☐	☐	☐	☐
	Security of online data	☐	☐	☐	☐	☐
	Password protection of all courses (e.g. enrolment key, access to tests)	☐	☐	☐	☐	☐
	Protection against viruses	☐	☐	☐	☐	☐
	Maintain **privacy of data** (e.g. students should not be able to view other students marks or assignment submissions, private messaging)	☐	☐	☐	☐	☐
	Provide an **audit trail** for changes made to marks in grade book	☐	☐	☐	☐	☐
	Provide a **secure set of user privileges** which determine permission levels (e.g. creation and updating learning materials and marks for teachers; read only for students)	☐	☐	☐	☐	☐
24.	The following **reliability characteristics** are necessary for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Capable of handling errors i.e. does not crash when invalid data is input/through malicious activity	☐	☐	☐	☐	☐
	High level of service availability 24 hours 7 days a week	☐	☐	☐	☐	☐
	Error-free system functions	☐	☐	☐	☐	☐
	Ability to resume working and **restore lost data** soon after failure	☐	☐	☐	☐	☐

25.	The following **usability characteristics** are important for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Understanding/comprehending how to use the VLS easily	☐	☐	☐	☐	☐
	Learning and operating the VLS quickly, confidently and reliably	☐	☐	☐	☐	☐
	Using the VLS without much effort i.e. tools should <u>not</u> be clumsy/cumbersome to work with	☐	☐	☐	☐	☐
	Aesthetically pleasing/ attractive interface	☐	☐	☐	☐	☐
	Graphical user interface design(appropriate icons to represent system functionality)	☐	☐	☐	☐	☐
	Course design wizards to assist in completing common tasks such as setting the course home page, syllabus, etc.	☐	☐	☐	☐	☐
	Clear, unambiguous, and intuitive **navigation** within the VLS	☐	☐	☐	☐	☐
	Error messages worded in simple terms that help to diagnose and correct problems	☐	☐	☐	☐	☐
	Standard conventions should be followed especially for functions like selecting files and displaying directories	☐	☐	☐	☐	☐
	Legible text screen display	☐	☐	☐	☐	☐
	Buttons labelled with tool tips that clarify their function	☐	☐	☐	☐	☐
	Online documentation for all roles (learner, instructor, administrator, instructional designer)	☐	☐	☐	☐	☐
	Context sensitive help {help while accomplishing required task; help with settings requirements for different tools }	☐	☐	☐	☐	☐
	Keyboard shortcuts for common actions	☐	☐	☐	☐	☐
	Defaults and templates for everything including course home page	☐	☐	☐	☐	☐
	Authentic to students' experiences of other systems or environments like Facebook, Twitter, Flickr	☐	☐	☐	☐	☐
	Customisation of user interface (e.g. change colour scheme, font, layout, disable things/items that are not needed; apply institutional images etc.)	☐	☐	☐	☐	☐
26.	The following **performance/efficiency characteristics** are important for the online classroom/ component of courses	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Respond quickly(e.g. when performing functions such as uploading and downloading files, creating test questions, taking online tests etc.)	☐	☐	☐	☐	☐
	Provide an **acceptable level of performance (**e.g. system should not freeze when large numbers of students are accessing the system at any one time)	☐	☐	☐	☐	☐
	Minimum number of steps/clicks to perform common tasks	☐	☐	☐	☐	☐

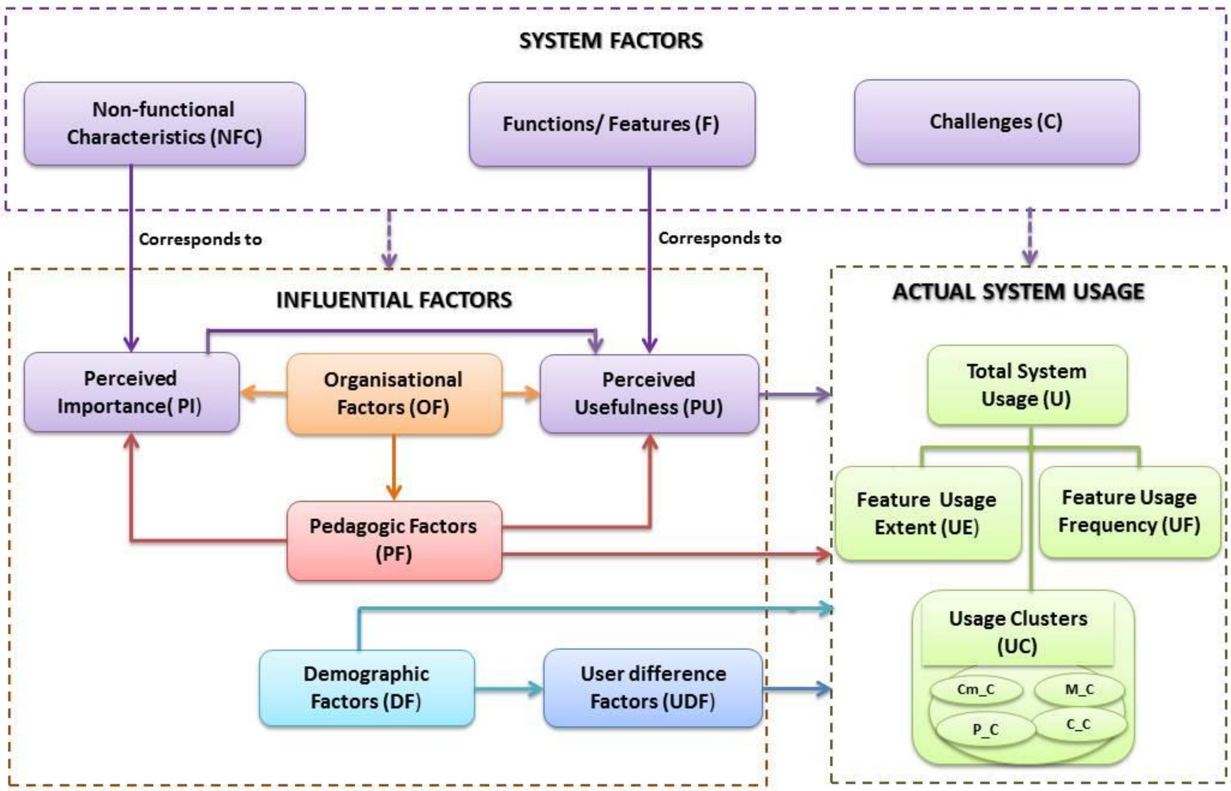
Section 7: Institutional support for online teaching and e-learning						
27.	The following institutional **e-learning capabilities** should be adequate to support the online classroom/ component of courses:	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**
	Instructional design and development support (e.g. experimental course for teachers, training and workshops for staff creating E-learning resources etc.)	☐	☐	☐	☐	☐
	User Support (e.g. technical assistance for students and staff; telephone help desk, logging of faults/ problems **etc**.)	☐	☐	☐	☐	☐
	Resource Support (e.g. more LAB facilities, more Wi-Fi hot spots, roll out of laptops for students etc.)	☐	☐	☐	☐	☐
	Institutional **policy/ guidelines and strategy for E-learning**	☐	☐	☐	☐	☐
	Showcasing of innovative E-learning practices at annual events like teaching and learning conferences, E-learning days	☐	☐	☐	☐	☐

Section 8: Challenges/barriers to online teaching and learning							
28.	**The following aspects are challenges to the success of online teaching and learning with a VLS**	**Strongly Agree**	**Agree**	**Neither Agree or Disagree**	**Disagree**	**Strongly Disagree**	**Not applicable**
	Problems based on students' prior learning experiences (e.g. computer illiteracy, information illiteracy, poor English language proficiency)	☐	☐	☐	☐	☐	☐
	Lack of a solid technology infrastructure (e.g. insufficient computer provisioning, unreliable technology, lack of dedicated teaching LABs etc.**)**	☐	☐	☐	☐	☐	☐
	Low **bandwidth**	☐	☐	☐	☐	☐	☐
	Distance mediation issues (e.g. lack of visual cues/body language and audio cues; absence of social, personal and emotional aspects in online teaching and learning)	☐	☐	☐	☐	☐	☐
	Discussion Forum Issues (e.g. poor student uptake of online discussions; difficulty of managing online discussion for large classes etc.)	☐	☐	☐	☐	☐	☐
	Subject discipline that are symbol based like sciences, mathematics, statistics do not lend itself to learning via asynchronous discussion groups	☐	☐	☐	☐	☐	☐
	Lack **of net etiquette guidelines** for online communication	☐	☐	☐	☐	☐	☐
	Training students on how to participate in online discussions	☐	☐	☐	☐	☐	☐

	Organisational policies(e.g. blocking access to social networking sites viz. Face book, Twitter, You Tube)	☐	☐	☐	☐	☐	☐
	File size limits for uploading too restrictive in disciplines that are graphics intensive	☐	☐	☐	☐	☐	☐
	E-learning is a **subculture** and not mainstream	☐	☐	☐	☐	☐	☐
	No **seamless integration** between VLS and other University systems	☐	☐	☐	☐	☐	☐
	Lack of commitment from top level management	☐	☐	☐	☐	☐	☐
	Licensing issues(e.g. copyright for materials placed online; creative commons licensing to grant creators copyright permission to their creative work)	☐	☐	☐	☐	☐	☐
	No forum for **user input on system design** issues	☐	☐	☐	☐	☐	☐
	Software technical issues when using different operating systems	☐	☐	☐	☐	☐	☐
	Access problems (e.g. lack of personal PCs with internet access, server is down, internet connectivity problems etc.)	☐	☐	☐	☐	☐	☐
	Difficulty of working with a VLS	☐	☐	☐	☐	☐	☐
	Making the change from traditional teaching styles to online teaching and learning styles	☐	☐	☐	☐	☐	☐
	Lack of support, training and help for online teaching	☐	☐	☐	☐	☐	☐
	Lack of time needed to design and **c**reate online lesson activities and online assessments	☐	☐	☐	☐	☐	☐
	Lack of incentives to motivate staff to teach online	☐	☐	☐	☐	☐	☐

APPENDIX 3: INTERVIEW SCHEDULE FOR CONFIRMATION OF VLSUM MODEL

The following questions relate to the VLSUM model below:



Section A: Relevance of INFLUENTIAL FACTORS component and relationships to other VLSUM components

Table 1: Evaluation Questions pertaining to INFLUENTIAL FACTORS component of VLSUM

VLSUM Components	Evaluation Questions	Yes	No	Comments
INFLUENTIAL FACTORS ➢ Organisational ➢ Perceived usefulness ➢ Perceived Importance ➢ Pedagogic ➢ User difference ➢ Demographic	Do you believe that the INFLUENTIAL FACTORS of VLSUM which conceptualizes *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*, *Perceived Importance corresponding to* SYSTEM FACTORS_*Non-functional characteristics*, *Pedagogic*, *Organisational* , *User difference* and *Demographic Factors* in Figure 1 is relevant to the use of VLSs?			

VLSUM Components	Evaluation Questions	Yes	No	Comments
INFLUENTIAL FACTORS_*Organisational Factors* → INFLUENTIAL FACTORS_*Perceived Usefulness*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Organisational Factors* (institutional e-learning capability support in respect of infrastructure, bandwidth, computer availability, instructional design & development support etc.) and INFLUENTIAL FACTORS_*Perceived usefulness* related to SYSTEM FACTORS_*Functions/Features* (e.g. course assessment, course communication) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Organisational Factors* → INFLUENTIAL FACTORS_*Perceived Importance*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Organisational Factors* (institutional e-learning capability resource support, user support etc.) and INFLUENTIAL FACTORS_*Perceived Importance* related to SYSTEM FACTORS_*Non-functional characteristics* (e.g. reliability, usability, performance) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Organisational Factors* → INFLUENTIAL FACTORS_*Pedagogic Factors*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Organisational Factors* (institutional e-learning capability support e.g. instructional design & development support, user support etc.) and INFLUENTIAL FACTORS_*Pedagogic Factors* (Pedagogic features e.g. teaching approaches, instructional design etc.) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Pedagogic Factors* → INFLUENTIAL FACTORS_*Perceived Usefulness*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Pedagogic Factors* (teaching approaches, instructional design, characteristics of online teaching) and INFLUENTIAL FACTORS_*Perceived usefulness* related to SYSTEM FACTORS_*Functions/Features* (e.g. course assessment, course communication) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Pedagogic Factors* → INFLUENTIAL FACTORS_*Perceived Importance*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Pedagogic Factors* (teaching approaches, instructional design, characteristics of online teaching) and INFLUENTIAL FACTORS_*Perceived Importance* related to SYSTEM FACTORS_*Non-functional Characteristics* (e.g. reliability, usability, performance) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Perceived Usefulness* → INFLUENTIAL FACTORS_*Perceived Importance*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Perceived Usefulness* related to SYSTEM FACTORS_*Functions/Features* (e.g. course assessment, course communication) and INFLUENTIAL FACTORS_*Perceived Importance* related to SYSTEM FACTORS_*Non-functional characteristics* (e.g. performance, security etc.) in Figure 1 is relevant?			

VLSUM Components	Evaluation Questions	Yes	No	Comments
INFLUENTIAL FACTORS_*Demographic Factors* → INFLUENTIAL FACTORS_*User Difference Factors*	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Demographic Factors* (e.g. system experience) and INFLUENTIAL FACTORS_*User Difference Factors* (e.g. Experience of online teaching of online teaching) in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Perceived Usefulness* → ACTUAL SYSTEM USAGE	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Perceived Usefulness* (related to SYSTEM FACTORS_ *Functions/Features*) and the ACTUAL SYSTEM USAGE component in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Pedagogic Factors* → ACTUAL SYSTEM USAGE	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Pedagogic Factors* (Pedagogic features) and the ACTUAL SYSTEM USAGE component in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*User Difference Factors* → ACTUAL SYSTEM USAGE	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*User Difference Factors* (E.g. user computer comfort level; teaching style preference and experiences of online teaching) and the ACTUAL SYSTEM USAGE component in Figure 1 is relevant?			
INFLUENTIAL FACTORS_*Demographic Factors* → ACTUAL SYSTEM USAGE	Do you believe that the relationship in VLSUM between INFLUENTIAL FACTORS_*Demographic Factors* (E.g. system experience and level of study (UG/PG) and the ACTUAL SYSTEM USAGE component in Figure 1 is relevant?			

Section B: Method for using the VLSUM model by managers/directors of e-learning or educational technology departments

The following 9 steps represent the process that managers/directors of e-learning or educational technology departments can follow to identify the composition of the three (3) components of VLSUM namely SYSTEM FACTORS, INFLUENTIAL FACTORS, and ACTUAL SYSTEM USAGE and the relationships between and within components with the intent to implementing interventions to optimize usage.

1. Examine the INFLUENTIAL FACTORS component of the VLSUM.
2. Select the first INFLUENTIAL FACTORS_*Perceived Usefulness*
   a. Examine the correspondence relationship between the INFLUENTIAL FACTORS_*Perceived Usefulness* and SYSTEMS FACTORS_*Functions/Features*.
   b. Examine the composition of the SYSTEMS FACTORS_*Functions/Features* comprising Assessment, Content creation and dissemination, Administration/ Management, Communication, Student productivity and involvement, and Student tracking that users (educators) deem to be useful for online teaching.
   c. Examine the positive correlation relationship between INFLUENTIAL FACTORS_*Perceived Usefulness* and ACTUAL SYSTEM USAGE.

d. Examine the *Total System Usage (U), Feature Usage Extent (UE), Feature Usage Frequency (UF)* and *Usage Clusters (UC)* representing ACTUAL SYSTEM USAGE.
e. Compare *Functions/Features* deemed to be useful against the number of functions/ features used and associated usage frequencies.
f. Develop and implement training programmes, and provide instructional design/development support to bridge the gap between what *Functions/ Features* are deemed useful and what *Functions/ Features* are used in the ACUTAL SYSTEM USAGE component.

3. Select the INFLUENTIAL FACTORS_*Perceived Importance*
   a. Examine the correspondence relationship between INFLUENTIAL FACTORS_*Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics.*
   b. Examine the composition of the SYSTEM FACTORS_*Non-functional Characteristics* deemed important by users (educators) which comprises the following: Flexibility, Security, Reliability, Usability, Performance and Standards compliance.
   c. Examine the positive correlation relationship between INFLUENTIAL FACTORS_ *Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics* and INFLUENTIAL FACTORS_*Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features.* The inference of this relationship is that users (educators) find *Functions/Features* and *Non-functional Characteristics* to be equally important in a VLS.
   d. Select a VLS that complies with the *Non-functional Characteristics* deemed important by users (educators) and ensure that the system installation/ implementation in an organisation guarantees characteristics such as security, reliability, and performance when using a VLS.
4. Select the INFLUENTIAL FACTORS_*Organisational Factors*
   a. Identify the composition of the *Organisational Factors,* which comprise e-learning support and Challenges.
   b. Identify the composition of e-learning support namely instructional design and development support, user support, resources support, and policy/guidelines.
   c. Identify the composition of Challenges namely technology infrastructure, training issues and general organisational challenges.
   d. Examine the positive correlation between *Organisational Factors and Perceived Usefulness* corresponding to SYSTEMS FACTORS_*Functions/Features*. This shows a relationship between the *Functions/Features* deemed useful and need for organisational e-learning support.
   e. Examine the positive correlation between *Organisational Factors and Perceived Importance* corresponding to SYSTEM FACTORS_*Non-functional Characteristics*. This shows a relationship between the importance attached to *Non-functional Characteristics* and need for organisational e-learning support.
   f. Examine the positive correlation between *Organisational Factors and Pedagogic Factors.* The correlational analysis shows a relationship between *Organisational Factors*: e-learning support and 3 *Pedagogic Factors* namely Pedagogic Features, Characteristics of online teaching, and Challenges. This means that users (educators) find e-learning support as being interrelated to Pedagogic Factors. In addition the correlational analysis shows a relationship between *Organisational Factors*: Challenges and 2 *Pedagogic Factors* namely Pedagogic Features and Challenges. This means that users (educators) find that there is a co-presence of organisational challenges and pedagogic challenges, which is also related to the need for pedagogic features.
   g. Examine the indirect relationship between *Organisational Factors* and ACTUAL SYSTEM USAGE. This relationship can be used to understand inadequate support and inhibiting factors. An understanding of organisational support e.g. resources and user support needed

and organisational challenges can form the basis for necessary improvements and/ or interventions by management to improve ACTUAL SYSTEM USAGE.

5. Select the INFLUENTIAL FACTORS_*Pedagogic Factors*
    a. Examine the composition of *Pedagogic Factors* namely sub-factors Pedagogic features, Characteristics of online teaching, and Challenges.
    b. Examine the composition of sub-factor Pedagogic Features namely the various teaching approaches and instructional design activities used by educators
    c. Examine the composition of sub-factor Characteristics of online teaching namely flexible delivery; better course planning; more learner centred; more collaborative learning; better tracking of students' progress; more teaching or instructional strategies, and better course management.
    d. Examine the composition of sub-factor Challenges of online teaching which include distance mediation, discussion forum, prior learning and discipline specific issues.
    e. Examine the positive correlation between *Pedagogic Factors* and ACTUAL SYSTEM USAGE. This relationship shows *Pedagogic Factors* directly influence ACTUAL SYSTEM USAGE.
    f. Examine the positive correlation between *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features.* This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Usefulness* corresponding to SYSTEM FACTORS_*Functions/Features*.
    g. Examine the positive correlation between *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_*Non-functional Characteristics.* This relationship shows the interrelatedness of *Pedagogic Factors* and *Perceived Importance* corresponding to SYSTEMS FACTORS_*Non-functional Characteristics.*
    h. Use the information on *Pedagogic Factors* as the basis for the implementation of professional teaching with technology training programmes to improve ACTUAL SYSTEM USAGE.
6. Select the INFLUENTIAL FACTORS_*Demographic Factors*
    a. Examine the composition of *Demographic Factors* namely System experience and Level of Study
    b. Examine the composition of sub-factor System experience namely length of usage and number of online/hybrid courses taught
    c. Examine the positive correlation between *Demographic Factors* that influence ACTUAL SYSTEM USAGE. This relationship shows that *Demographic Factors* directly influences ACTUAL SYSTEM USAGE.
    d. Use the information on *Demographic Factors* (such as system experience and level of study (UG/PG)) to identify and justify the need for *customised* instructional design/ development support based on level of study and system experience.
    e. Examine the correlation between *Demographic Factors:* System experience and *User Difference Factors:* Experience of online teaching. This relationship shows that as educators get more system experience they display a higher positive experience of online teaching. Use this information to understand that ACTUAL SYSTEM USAGE improves as educators gain more experience of the system.
7. Select INFLUENTIAL FACTORS_*User Difference Factors*
    a. Examine the composition of *User Difference Factors* namely Computer comfort level, Teaching style preference, and Experience of online teaching
    b. Examine the composition of sub-factor Experience of online teaching namely comfort, effectiveness, effort involved, and communication ease
    c. Examine the composition of sub-factor Challenges namely lack of time, changing mind-set to online teaching and lack of confidence

d. Examine the correlation between *User Difference Factors* and ACTUAL SYSTEM USAGE. This relationship shows that *User Difference Factors* directly influences ACTUAL SYSTEM USAGE
e. Use this information on *User Difference Factors* to understand inhibiting *factors*, which can be used to design and implement *group training programmes* and/or provide *individualised instructional design/ development support* to improve ACTUAL SYSTEM USAGE.

8. Select the ACTUAL SYSTEM USAGE component
   a. Examine the sub-components of ACTUAL SYSTEM USAGE namely *Total System Usage Feature Usage Extent*, *Feature Usage Frequency*, and *Usage Clusters*
   b. Use this information to understand the *Total System Usage* using an average frequency score of all functions/features; *Feature Usage Extent* by the breadth of functions/ features used; *Feature Usage Frequency* by the average frequency score of individual functions/ features used; and *Usage Clusters* by the average frequency score of groupings of functions/features used.
9. Re-assess ACTUAL SYSTEM USAGE once training and instructional design/ development interventions identified in steps 2-7 have been implemented in the form of a follow-up usage survey.

Question: Do you believe that the method for using VLSUM is practical for implementation and would promote improved VLS feature usage in higher education? (Yes/ No). Elaborate.

Section C: Confirmation of each of the INFLUENTIAL FACTORS of VLSUM, the ACTUAL SYSTEM USAGE component, and the usefulness of information/knowledge on Organisational , Pedagogic, User difference and Demographic Factors to managers/directors of e-learning or educational technology departments as well as educational technologists/instructional designers

Part 1:

Table 2: Confirmation of INFLUENTIAL FACTORS_*Perceived Usefulness*

During development of VLSUM, the following INFLUENTIAL FACTORS_*Perceived usefulness* corresponding to *Systems Factors: Functions/Features* namely course assessment; course content creation and dissemination; course administration/management; course communication; student productivity and involvement; and student tracking were identified. Do you believe these factors are adequate to represent INFLUENTIAL FACTORS_*Perceived usefulness* related to *Systems factors: Functions/Features*?	**Yes**	**No**
If No, please motivate your answer:		

Table 3: Confirmation of INFLUENTIAL FACTORS_*Perceived Importance*

During development of VLSUM the following INFLUENTIAL FACTORS_*Perceived Importance* related to the *Systems Factors: VLS Non-functional characteristics* namely flexibility; standards compliance (SCORM compliancy); security; reliability; usability and performance/ efficiency were identified. Do you believe these factors are adequate to represent INFLUENTIAL FACTORS_*Perceived Importance* related to the *Systems Factors: VLS Non-functional characteristics*?	**Yes**	**No**
If No, please motivate your answer:		

Table 4: Confirmation of INFLUENTIAL FACTORS_*Pedagogic Factors*

During development of VLSUM the following INFLUENTIAL FACTORS_*Pedagogic Factors* namely pedagogic features (teaching approaches and instructional design activities) and characteristics of online teaching (flexible delivery; better course planning; more learner centered; more collaborative learning; better tracking of students' progress; more teaching or instructional strategies, and better course management) were identified. Do you believe these factors are adequate to represent *Influential Factors_Pedagogic Factors?*	**Yes**	**No**
If No, please motivate your answer:		

Table 5: Confirmation of INFLUENTIAL FACTORS_*Organisational Factors*

During development of VLSUM the following INFLUENTIAL FACTORS_*Organisational Factors* were identified namely organisational support factors (instructional design and development support, user support, resource support, organisational policies/guidelines) and organisational challenges. Do you believe these factors are adequate to represent INFLUENTIAL FACTORS_ *Organisational Factors*?	**Yes**	**No**
If No, please motivate your answer:		

Table 6: Confirmation of INFLUENTIAL FACTORS_*User Difference Factors*

During development of VLSUM the following INFLUENTIAL FACTORS_*User Difference Factors* were identified namely computer comfort, teaching style preference, Experience of online teaching of online teaching, and user challenges. Do you believe these factors are adequate to represent the INFLUENTIAL FACTORS_*User Difference Factors*?	**Yes**	**No**
If No, please motivate your answer:		

Table 7: Confirmation of INFLUENTIAL FACTORS_*Demographic Factors*

During development of VLSUM the following INFLUENTIAL FACTORS_*Demographic factors* were identified namely system experience and level of study (UG/PG). Do you believe these are adequate to represent the INFLUENTIAL FACTORS_*Demographic Factors*?	**Yes**	**No**
If No, please motivate your answer:		

Table 8: Confirmation of ACTUAL SYSTEM USAGE component

During development of VLSUM the following ACTUAL SYSTEM USAGE sub-components were identified namely *Total System Usage (U),* VLS feature usage extent (UE), VLS feature usage frequency (UF), and VLS usage clusters (UC). Do you believe these are sub-components are adequate to represent the ACTUAL SYSTEM USAGE component?	**Yes**	**No**
If No, please motivate your answer:		

Part 2:

The following checklist represents information/knowledge in the form of INFLUENTIAL FACTORS_ *Organisational factors,* INFLUENTIAL FACTORS_*Pedagogic Factors;* INFLUENTIAL FACTORS_ *User Difference Factors*, and INFLUENTIAL FACTORS_*Demographic Factors* around the use of VLSs in higher education. Please indicate agreement or lack thereof on the usefulness of information/knowledge on the various factors for improving ACTUAL SYSTEM USAGE in higher education.

Table 9: INFLUENTIAL FACTORS_*Pedagogic Factors*

INFLUENTIAL FACTORS: Pedagogic Factors	Information/knowledge on the following INFLUENTIAL FACTORS_*Pedagogic Factors* is useful to support educators to <u>design online courses</u> making provision for preferred teaching methods and instructional and course design activities	**Agree**	**Neither Agree or Disagree**	**Disagree**
1. Teaching Approaches	Promoting an *expert's point of view*	☐	☐	☐
	Disseminating knowledge from lecturer to learner	☐	☐	☐
	Getting students to *reflect on the learning* process (e.g. journal keeping, probing questions to reflect on etc.)	☐	☐	☐
	Allowing individual students to support one another in *co-constructing the facts, knowledge, and processes* of a content area or discipline	☐	☐	☐
2. Instructional Design	*Structured, guided* learning activities	☐	☐	☐
	Situated and contextual learning activities (i.e. by allowing teachers and students to seamlessly integrate real-world authentic activities)	☐	☐	☐
	Collaborative learning activities i.e. providing students with the tools to discuss and explain their own ideas and develop and refine documents in groups	☐	☐	☐
	Active learning activities (e.g. discussions, lessons, quizzes, problem solving, learning portfolios, peer evaluations; post reactions/ reflections to specific topics etc.)	☐	☐	☐
	Differentiated instruction to cater for differing levels of computer literacy, information literacy and English language proficiency	☐	☐	☐
	Differentiated Instruction to cater for different learning styles	☐	☐	☐
	Course planning activities	☐	☐	☐
	Record of conversations/ discussions/agreements/arrangements for later retrieval	☐	☐	☐
	Rules and procedures for online course activities and discussions	☐	☐	☐
	S*tudent feedback* on quality and effectiveness of e-learning experience (survey instruments)	☐	☐	☐
3. Characteristics of online teaching	Information/knowledge on the following **Characteristics of online teaching** is useful to support educators to <u>design online courses</u> in order to help educators realize the characteristics of online teaching.			
	Flexible delivery	☐	☐	☐
	Better course planning	☐	☐	☐
	More learner centered	☐	☐	☐
	More collaborative learning	☐	☐	☐
	Better tracking of students' progress	☐	☐	☐
	More teaching or instructional strategies	☐	☐	☐
	Better course management	☐	☐	☐

Table 10: INFLUENTIAL FACTORS_*Organisational Factors*

INFLUENTIAL FACTORS: Organisational Factors	Information/knowledge on the following INFLUENTIAL FACTORS_*Organisational Factors* can be used to initiate improvements or training interventions and instructional design/ development support to improve ACTUAL SYSTEM USAGE.	**Agree**	**Neither Agree or Disagree**	**Disagree**
	Instructional design and development support (e.g. experimental course for teachers, training and workshops for staff creating e-learning resources etc.)	☐	☐	☐
	User Support **(**e.g. technical assistance for students and staff; telephone help desk, logging of faults/ problems etc.)	☐	☐	☐
	Resource Support (e.g. more LAB facilities, more Wi-Fi hot spots, roll out of laptops for students etc.)	☐	☐	☐
	Institutional *policy/ guidelines and strategy for E-learning*	☐	☐	☐
	Showcasing of innovative e-learning practices at annual events like teaching and learning conferences, E-learning days	☐	☐	☐

Table 11: INFLUENTIAL FACTORS_*User Difference Factors*

INFLUENTIAL FACTORS: User Difference Factors	Information/knowledge on the following INFLUENTIAL FACTORS_*User Difference Factors* is useful for identifying enabling and inhibiting factors to ACTUAL SYSTEM USAGE with the intent to address inhibiting factors:	**Agree**	**Neither Agree or Disagree**	**Disagree**
	Computer comfort level (with office computer applications and programming)	☐	☐	☐
	Teaching style preference (Traditional face to face, blended or online teaching only)	☐	☐	☐
	Experience of online teaching of online teaching (Effort involved in terms of planning and communication, Amount of work involved, Amount of student support needed; Ease of communication; Effectiveness of online delivery)	☐	☐	☐

Table 12: INFLUENTIAL FACTORS_*Demographic Factors*

INFLUENTIAL FACTORS: Demographic Factors	Information/knowledge on the following INFLUENTIAL FACTORS_*Demographic Factors* is useful for understanding the role of demographic factors on ACTUAL SYSTEM USAGE:	**Agree**	**Neither Agree or Disagree**	**Disagree**
	Level of study(UG/PG)	☐	☐	☐
	System experience	☐	☐	☐

Table 13: INFLUENTIAL FACTORS_*User Difference Factors*_user challenges

INFLUENTIAL FACTORS: User Difference Factors_user challenges	Information/knowledge on the following INFLUENTIAL FACTORS_*User Difference Factors_user challenges* is useful for identifying and addressing inhibiting factors to ACTUAL SYSTEM USAGE:	**Agree**	**Neither Agree or Disagree**	**Disagree**
	Making the change from traditional teaching styles to online teaching and learning styles	☐	☐	☐
	Lack of time to design and create online lesson activities and online assessments	☐	☐	☐
	Lack of incentives to motivate staff to teach online	☐	☐	☐

Table 14: INFLUENTIAL FACTORS_*Organisational Factors*_organisational challenges

INFLUENTIAL FACTORS: Organisational Factors_ organisational challenges	Information/knowledge on the following INFLUENTIAL FACTORS_*Organisational Factors_organisational challenges* is useful for identifying and addressing inhibiting factors to ACTUAL SYSTEM USAGE:	**Agree**	**Neither Agree or Disagree**	**Disagree**
	Access problems (e.g. lack of personal PCs with internet access, server is down, internet connectivity problems etc.)	☐	☐	☐
	Licensing issues (e.g. copyright for materials placed online; creative commons licensing to grant creators copyright permission to their creative work)	☐	☐	☐
	Lack of commitment from top level management	☐	☐	☐
	No *seamless integration* between VLS and other University systems	☐	☐	☐
	e-learning is a *subculture* and not mainstream	☐	☐	☐
	File size limits for uploading too restrictive in disciplines that are graphics intensive	☐	☐	☐
	Organisational policies (e.g. blocking access to social networking sites viz. Face book, Twitter, You Tube)	☐	☐	☐
	Lack of a solid technology infrastructure (e.g. insufficient computer provisioning, unreliable technology, lack of dedicated teaching LABs etc.**)**	☐	☐	☐
	Low *bandwidth*	☐	☐	☐
	No forum for *user input on system design* issues	☐	☐	☐

APPENDIX 4: ANALYSIS ON THE RESPONSES

Application of chi-square goodness-of-fit test to Question 15 of Questionnaire (refer to Appendix 2) pertaining to system usage

Function/ Feature	DUT p-value	UKZN p-value	Whole sample p-value
15.1 Presenting course information	.000	.000	.000
15.2 Posting course content	.000	.000	.000
15.3 E-mail communication	.007	.000	.007
15.4 Online real-time chat with students	.039	.000	.039
15.5 Online threaded discussion forum	.530	.185	.530
15.6 Shared whiteboard	.000	.000	.000
15.7 Blogs	.006	.000	.006
15.8 Wikis (internal/ external) for collective authoring of documents	.000	.000	.000
15.9 Course announcement/ notices/ news	.000	.000	.000
15.10 Course calendar and schedule	.001	.000	.001
15.11 Online glossary	.827	.000	.827
15.12 File exchanges	.273	.000	.273
15.13 Student online journals	.017	.000	.017
15.14 Online quizzes/self-tests	.625	.001	.625
15.15 Online test	.002	.000	.002
15.16 Online assignment submission	.001	.000	.001
15.17 Online marking of assessments/ activities with grading and comments	.339	.000	.339
15.18 Peer reviews of student posts	.015	.000	.015
15.19 Grading of peer reviews	.000	.000	.000
15.20 Peer evaluation of assignments	.000	.000	.000
15.21 Tracking student participation in online discussion forums	.024	.000	.024
15.22 Grading student participation in online discussion forums/blogs	.000	.000	.000
15.23 Creating lessons	.013	.000	.013
15.24 Publishing marks in grade book	.002	.000	.002
15.25 Online surveys	.000	.000	.000
15.26 Online polls	.000	.000	.000

APPENDIX 5: STATISTICS USED FOR THIS RESEARCH

Frequencies	Frequencies refer to the number of times various subcategories of a certain phenomenon occur from which the percentage and cumulative percentage of their occurrence can easily be calculated.
Bar charts and pie charts	Frequencies can be visually displayed as bar charts, histograms or pie charts.
Percentage	A percentage is a number or ratio as a fraction of 100
Chi-square goodness-of-fit	A test applied to see whether any response option was selected significantly i.e. more or less often than the others
Cronbach's Alpha	Cronbach's α (alpha) is a coefficient of internal consistency (reliability) that indicates how well the items in a set are positively correlated to one another. Cronbach's alpha is computed in terms of the average inter-correlations among items measuring the concept. The closer Cronbach's alpha is to 1, the higher the internal consistency.
Mean	A simple statistical model of the centre of a distribution of scores
Standard Deviation	An estimate of the average variability (spread) of a set of data measured in the same units of measurement as the original data. It is the square root of the variance.
Standard Error Mean	It is the standards deviation of the sampling distribution of a statistic. For a given statistic (e.g. mean) it tells us how much variability there is in this statistic across samples from the same population.
Independent sample t-test	A test using the t-statistic that establishes whether two means collected from independent samples differ significantly.
Pearson Product-moment correlation coefficient	This is a standardised measure of the strength of relationship between two variables. It can take any value from -1 (as one variable changes, the other changes in the opposite directly by the same amount), through 0 (as one variable changes, the other changes in the same direction by the same amount), to +1 (as one variable changes, the other changes in the same direction by the same amount)
Factor	Another name for an independent variable or predictor that is typically used when describing experimental design.
Factor analysis	A multivariate technique for identifying whether the correlations between a set of observed variables stem from their relationship to one or more latent variables in the data, each of which takes the form of a linear model.
ANOVA	Analysis of covariance is a statistical procedure that uses the F-ratio to test the overall fit of a linear model. In experimental research this linear model is defined in terms of group means and the resulting ANOVA is an overall test of whether group means differ .
Kruskal Wallis test – chi-square value	Non-parametric test of whether more than two independent groups differ.
Cluster analysis	Cluster analysis is an exploratory technique that can be used to visualize patterns in a project by grouping sources or nodes that share similar words, similar attribute values, or are coded similarly by nodes.
Thematic analysis	Thematic analysis is a commonly used method of analysis in qualitative research and allows the researcher to capture the complex meanings within a textual data set

APPENDIX 6: EXAMPLES OF CORRELATIONS BETWEEN THEMES/FACTORS

Examples of correlations between the different themes/factors for DUT	
Content category A	**Content category B**
VLS functions deemed useful sub-function 'course content delivery and management' (multimedia content)	Organisational theme/factor sub-function 'organisational challenges'-(technology infrastructure- bandwidth)
VLS functions deemed useful sub-function 'user management' (user rights and privileges)	Organisational theme/factor sub-function 'Organisational Challenge' (organisational practice-registration done by administrator)
VLS functions deemed useful sub-function ' online assessment'	Organisational theme/factor sub-function 'Organisational Challenge' (technology infrastructure-computer availability)
Pedagogic theme/factor sub-function 'pedagogic challenge' (Uptake of discussion forums)	VLS functions deemed useful sub-function 'online marking and grading' (awarding marks)
Organisational theme theme/factor sub-function 'Organisational challenges' (training issues)	System usage
Pedagogic theme/factor sub-function 'pedagogic aspect' (learning strategies)	System usage (online threaded discussions, quizzes, glossaries, reflective journal etc.)
VLS functions deemed useful sub-function 'communication and collaboration'	VLS functions deemed useful sub-function 'student productivity and involvement'
Pedagogic theme/factor sub-function 'pedagogic aspect' (pedagogic approaches)	System usage (tools used)
User difference theme/factor Sub-function 'User difference challenges' (changing mind-set -reluctance)	Pedagogic theme/factor sub-function 'non-functional characteristics' (usability issues)

Examples of correlations between the different themes/factors for UKZN

Examples of correlations between the different themes/factors for UKZN	
Content category A	**Content category B**
VLS functions deemed useful • sub-function ' online assessment'	Organisational theme/factor • sub-function 'Organisational Challenge'-(technology infrastructure-computer availability)
VLS functions deemed useful • sub-function ' online assessment' • sub-function 'online assignment	VLS functions deemed useful • sub-function ' online marking and grading' • sub-function 'online grade book' • sub-function 'communication and collaboration' (e-mail confirmation)
Pedagogic theme/factor • sub-function ' pedagogic challenge' (review of discussion forum posts)	VLS functions deemed useful • sub-function 'online marking and grading' (awarding marks)
Organisational theme/factor • sub-function 'Organisational challenges' (training issues)	System usage (grade book)
Pedagogic theme/factor	System usage (online threaded discussions, quizzes,

Examples of correlations between the different themes/factors for UKZN	
Content category A	**Content category B**
• sub-function ‘pedagogic aspect’ (learning strategies)	glossaries, reflective journal etc.)
VLS functions deemed useful • sub-function ‘communication and collaboration’	VLS functions deemed useful • sub-function ‘student productivity and involvement’
VLS functions deemed useful • sub-function ‘communication and collaboration’ (online discussion forums)	VLS functions deemed useful • sub-function ‘communication and collaboration’ (integrated e-mail)
VLS functions deemed useful • sub-function ‘communication and collaboration’ (online discussion forums)	VLS functions deemed useful • sub-function ‘ online marking and grading’ • Sub-function ‘online grade book’ • Sub-function ‘content delivery and management’ (file sharing)
Pedagogic theme/factor • sub-function ‘pedagogic aspect’ (pedagogic approaches)	System usage (tools used)
Pedagogic theme/factor • sub-function ‘pedagogic aspect’ (pedagogic approaches- teacher centred)	VLS functions deemed useful • Sub-function ‘content delivery and management’